

MR-E Super



EZ Motion E series

S U P E R

User-friendly servo with easy operation



Reducing workload with high performance and *Enhancing the system cost*



1. High Performance

- High-accuracy positioning
(Resolution per servo motor: 131072p/rev)
- High responsiveness
- Vibration can be suppressed by the adaptive vibration suppression control function.
- Optimum tuning is possible with a personal computer and optional setup software MR Configurator.
- 2 types of interface:
 - Pulse train interface for position control and internal speed control (MR-E-A-KH003)
 - Analog input interface for speed control and torque control (MR-E-AG-KH003)

2. Easy To Use

- Connectors have been adapted for the servo amplifier terminal block, thereby reducing the time required for wiring.
- Connectors are located on the front of the servo amplifier, thereby connecting the cables easily.
- Gain settings can be performed easily by real-time auto-tuning function.

easy operation
performance

EZ Motion E series

S U P E R

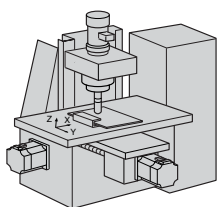
3. Global Standard Products

- Compatible with global standards.
- MR-E Super conforms to EN, UL and CSA standards.



Extensive Applications

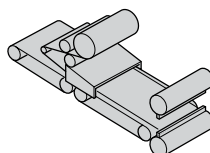
Processing machines or machine tools



- Grinding machines
- Transfer machines
- Loaders/unloaders
- Wood working machines
- Dedicated machines

Various positioning can be completed easily with pulse trains.

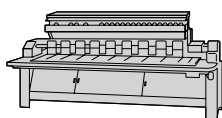
Food processing machines, packing machines or feeders



- Pillow packing machines
- Filling machines
- Label printing, label attaching machines
- Bag manufacturing machines
- Press feeders
- Roll feeders

The IP65 rated servo motor can be used safely for food processing applications.

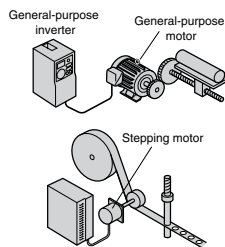
Textile machines



- Weaving machines
- Embroidery machines
- Knitting machines
- Winding machines
- Stranding machines
- Paper manufacturing machines

High-speed and high-accuracy applications are possible, enabling easy replacement with conventional devices.



Enhancing machine performance



- Replacement of inverters, stepping motors or DC servos
- Replacement from clutch, mechanical structure systems or hydraulic/air cylinders

By using the servo as an alternative to legacy products, higher quality can be achieved.

Servo Motor Series

Servo motor series		Rated speed (maximum speed) (r/min)	Rated output (kW)	With electro- magnetic brake (B)	IP rating	Feature	Application examples
Small capacity series	● HF-KN 	3000 (4500)	4 types 0.1, 0.2, 0.4, 0.75	✓	IP65 Excluding the shaft-through portion	Stable control from low to high speeds allows compliance with a variety of applications.	<ul style="list-style-type: none"> • Belt drives • Robots • Mounters • Sewing machines • X-Y tables • Food processing machines
	● HF-SN 	2000 (3000)	4 types 0.5, 1.0, 1.5, 2.0	✓	IP67 Excluding the shaft-through portion		<ul style="list-style-type: none"> • Material handling systems • Robots • X-Y tables

Model Designation

■For servo amplifier

MR-E- 10 A -KH003

MR-E Super

A : Pulse train interface
AG : Analog input interface

List of compatible servo motors

Symbol	HF-KN	HF-SN
10	13	—
20	23	—
40	43	—
70	73	52
100	—	102
200	—	152, 202

- Conforms to following standards:
EN, UL and CSA

■For servo motor

HF-KN

1

3

B

J

Symbol	Servo motor series
HF-KN	Low inertia, small capacity
HF-SN	Medium inertia, medium capacity

Symbol	Rated output (kW)
1 to 7	0.1 to 0.75
10 to 20	1.0 to 2.0

Symbol	Rated speed (r/min)
2	2000 (Note 1)
3	3000 (Note 2)

Notes: 1. 2000r/min is only for the HF-SN.
2. 3000r/min is only for the HF-KN.

Symbol	Oil seal
J	Installed (Note 1)
None	None (Note 2)

Notes: 1. An oil seal is attached as a standard for all servo motors.
2. Available in HF-KN13 to HF-KN43.

Symbol	Electromagnetic brake
None	None
B	Installed

Note: Refer to "Electromagnetic brake specifications" in this catalog for the available models and detailed specifications.

Symbol	Shaft end
None	Standard (Straight shaft)
K	Key shaft (with/without key) (Note 1)
D	D-cut shaft (Note 1)

Notes: 1. Refer to "Special shaft end specifications" in this catalog for the available models and detailed specifications.

- Conforms to following standards:
EN, UL and CSA

Servo Motor Specifications and Characteristics

HF-KN series servo motor specifications

Servo motor series			HF-KN series (Low inertia, small capacity)			
Servo motor model			HF-KN13(B)J	HF-KN23(B)J	HF-KN43(B)J	HF-KN73(B)J
Compatible servo amplifier model			MR-E-10A/AG-KH003	MR-E-20A/AG-KH003	MR-E-40A/AG-KH003	MR-E-70A/AG-KH003
Power supply capacity (Note 1) (kVA)			0.3	0.5	0.9	1.3
Continuous running duty	Rated output (W)		100	200	400	750
	Rated torque (Note 9) (N·m [oz·in])		0.32 (45.3)	0.64 (90.6)	1.3 (184)	2.4 (340)
Maximum torque (N·m [oz·in])			0.95 (135)	1.9 (269)	3.8 (538)	7.2 (1020)
Rated speed (r/min)			3000			
Maximum speed (r/min)			4500			
Permissible instantaneous speed (r/min)			5175			
Power rate at continuous rated torque (kW/s)			11.5	16.9	38.6	39.9
Rated current (A)			0.8	1.4	2.7	5.5
Maximum current (A)			2.4	4.2	8.1	17
Regenerative braking frequency (Note 2, 3) (times/min)			(Note 4)	(Note 4)	249	140
Moment of inertia J (×10 ⁻⁴ kg·m ²) [J (oz·in ²)]	Without electromagnetic brake		0.088 (0.481)	0.24 (1.31)	0.42 (2.30)	1.43 (7.82)
	With electromagnetic brake		0.090 (0.492)	0.31 (1.69)	0.50 (2.73)	1.63 (8.91)
Recommended load to motor inertia ratio			Maximum of 15 times the moment of inertia of the servo motor (Note 5)			
Speed/position detector			Incremental 17-bit encoder (resolution: 131072 p/rev)			
Oil seal			Attached. Without oil seal is also available.			Attached.
Insulation class			Class B			
Structure			Totally enclosed non ventilated (IP rating: IP65) (Note 6)			
Environment (Note 8)	Ambient temperature		0 to 40°C (32 to 104°F) (non freezing), storage: -15 to 70°C (5 to 158°F) (non freezing)			
	Ambient humidity		80% RH maximum (non condensing), storage: 90% RH maximum (non condensing)			
	Atmosphere		Indoors (no direct sunlight); no corrosive gas, inflammable gas, oil mist or dust			
	Elevation		1000m or less above sea level			
	Vibration (Note 7)		X: 49m/s ² Y: 49m/s ²			
Mass (kg [lb])	With oil seal	Without electromagnetic brake	0.6 (1.4)	1.2 (2.7)	1.6 (3.6)	3.1 (6.9)
		With electromagnetic brake	0.8 (1.8)	1.6 (3.6)	2.0 (4.4)	4.1 (9.1)
	Without oil seal	Without electromagnetic brake	0.5 (1.1)	1.0 (2.2)	1.4 (3.1)	—
		With electromagnetic brake	0.7 (1.6)	1.4 (3.1)	1.8 (4.0)	—

Notes: 1. The power supply capacity varies depending on the power supply's impedance.

2. The regenerative braking frequency shows the permissible frequency when the motor without a load decelerates from the rated speed to a stop. When a load is connected; however, the value will be the table value/(m+1), where m=moment of inertia of the load/moment of inertia of the servo motor. When the operating speed exceeds the rated speed, the regenerative braking frequency is inversely proportional to the square of (operating speed/rated speed). If the operating speed changes frequently or when the regeneration is constant (as with vertical feeds), find the regenerative heating value (W) in operation. Provisions must be made to keep this heating value below the tolerable regenerative power (W). Optimal regenerative resistor varies for each system. Refer to the section "Options ● Optional regeneration unit" in this catalog for details on the tolerable regenerative power (W).

3. The regenerative braking frequency of the 600W or smaller servo amplifier may fluctuate due to the affect of the power voltage since the energy charged by the electrolytic capacitor in the servo amplifier is large.

4. There are no limits on regeneration frequency as long as the effective torque is within the rated torque range. However, the load to motor inertia ratio must be 15 times or less.

5. Contact your local sales office if the load to motor inertia ratio exceeds the value in the table.

6. The shaft-through portion is excluded.

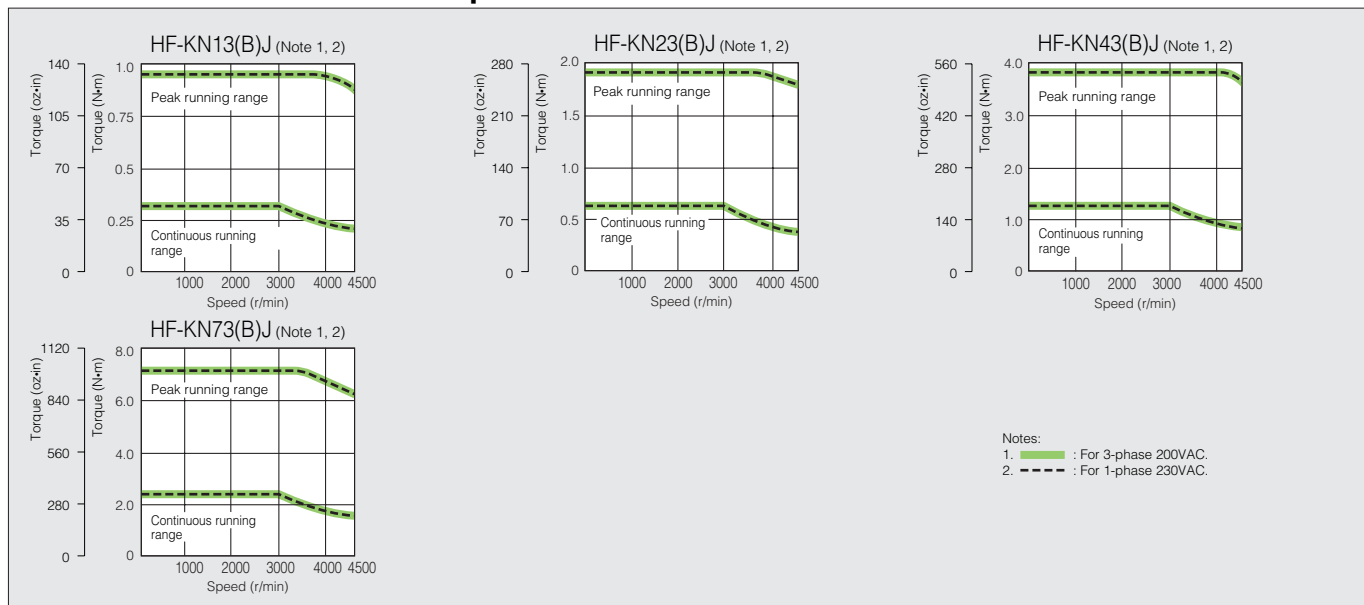
7. The vibration direction is shown in the diagram to the right. The numeric value indicates the maximum value of the component (commonly the bracket in the opposite direction of the motor shaft). Fretting of the bearing occurs easily when the motor stops, so maintain vibration to approximately one-half of the allowable value.

8. In the environment where the servo motor is exposed to oil mist, oil and/or water, a standard specification servo motor may not be usable. Contact your local sales office for more details.

9. When unbalanced torque is generated, such as in a vertical lift machine, it is recommended that the unbalanced torque of the machine be kept under 70% of the motor's rated torque.



HF-KN series servo motor torque characteristics



HF-SN series servo motor specifications

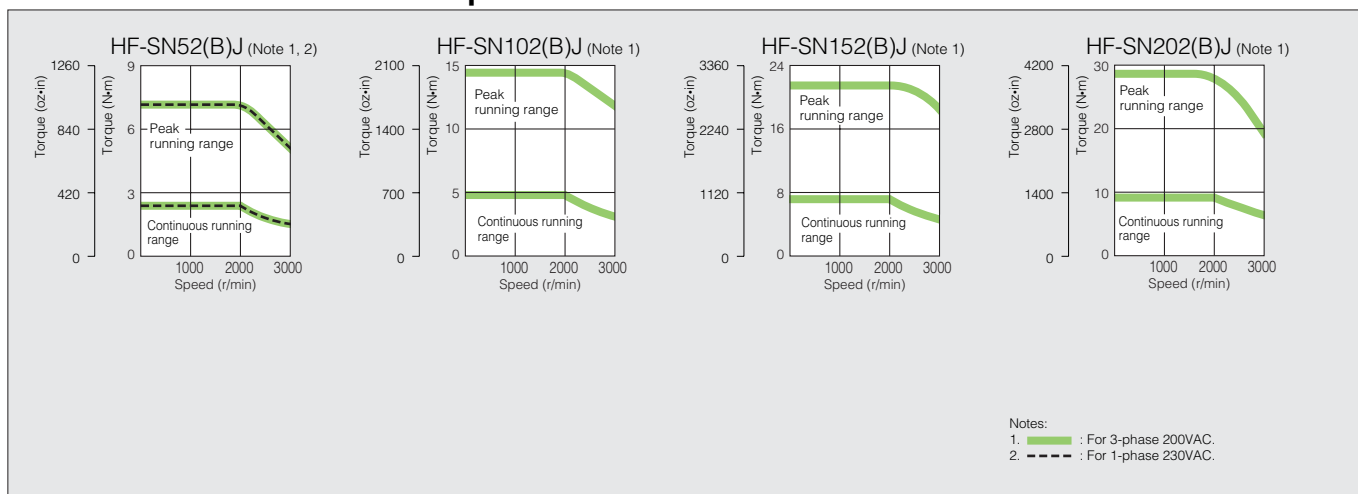
Servo motor series		HF-SN series (Medium inertia, medium capacity)			
Servo motor model		HF-SN52(B)J	HF-SN102(B)J	HF-SN152(B)J	HF-SN202(B)J
Compatible servo amplifier model		MR-E-70A/AG-KH003	MR-E-100A/AG-KH003	MR-E-200A/AG-KH003	
Power supply capacity (Note 1) (kVA)		1.0	1.7	2.5	3.5
Continuous running duty	Rated output (kW)	0.5	1.0	1.5	2.0
	Rated torque (Note 8) (N·m [oz·in])	2.39 (338)	4.77 (675)	7.16 (1010)	9.55 (1350)
Maximum torque (N·m [oz·in])		7.16 (1010)	14.3 (2020)	21.5 (3040)	28.6 (4050)
Rated speed (r/min)		2000			
Maximum speed (r/min)		3000			
Permissible instantaneous speed (r/min)		3450			
Power rate at continuous rated torque (kW/s)		9.34	19.2	28.8	23.8
Rated current (A)		2.9	5.3	8.0	10
Maximum current (A)		8.7	16	24	30
Regenerative braking frequency (Note 2, 3) (times/min)		120	62	152	71
Moment of inertia J (x10 ⁻⁴ kg·m ²) [J (oz·in ²)]	Without electromagnetic brake	6.1 (33.4)	11.9 (65.1)	17.8 (97.3)	38.3 (209)
	With electromagnetic brake	8.3 (45.4)	14.0 (76.5)	20.0 (109)	47.9 (262)
Recommended load to motor inertia ratio		Maximum of 15 times the moment of inertia of the servo motor (Note 4)			
Speed/position detector		Incremental 17-bit encoder (resolution: 131072 p/rev)			
Oil seal		Attached			
Insulation class		Class F			
Structure		Totally enclosed non ventilated (IP rating: IP67) (Note 5)			
Environment (Note 7)	Ambient temperature	0 to 40°C (32 to 104°F) (non freezing), storage: -15 to 70°C (5 to 158°F) (non freezing)			
	Ambient humidity	80% RH maximum (non condensing), storage: 90% RH maximum (non condensing)			
	Atmosphere	Indoors (no direct sunlight); no corrosive gas, inflammable gas, oil mist or dust			
	Elevation	1000m or less above sea level			
	Vibration (Note 6)	X : 24.5m/s ² Y : 24.5m/s ²			X : 24.5m/s ² Y : 49m/s ²
Mass (kg [lb])	Without electromagnetic brake	4.8 (11)	6.5 (15)	8.3 (19)	12 (27)
	With electromagnetic brake	6.7 (15)	8.5 (19)	10.3 (23)	18 (40)

Notes: 1. The power supply capacity varies depending on the power supply's impedance.

- The regenerative braking frequency shows the permissible frequency when the motor without a load decelerates from the rated speed to a stop. When a load is connected; however, the value will be the table value/(m+1), where m=moment of inertia of the load/moment of inertia of the servo motor. When the operating speed exceeds the rated speed, the regenerative braking frequency is inversely proportional to the square of (operating speed/rated speed). If the operating speed changes frequently or when the regeneration is constant (as with vertical feeds), find the regenerative heating value (W) in operation. Provisions must be made to keep this heating value below the tolerable regenerative power (W). Optimal regenerative resistor varies for each system. Refer to the section "Options ● Optional regeneration unit" in this catalog for details on the tolerable regenerative power (W).
- The regenerative braking frequency of the 600W or smaller servo amplifier may fluctuate due to the affect of the power voltage since the energy charged by the electrolytic capacitor in the servo amplifier is large.
- Contact your local sales office if the load to motor inertia ratio exceeds the value in the table.
- The shaft-through portion is excluded.
- The vibration direction is shown in the diagram to the right. The numeric value indicates the maximum value of the component (commonly the bracket in the opposite direction of the motor shaft). Fretting of the bearing occurs easily when the motor stops, so maintain vibration to approximately one-half of the allowable value.
- In the environment where the servo motor is exposed to oil mist, oil and/or water, a standard specification servo motor may not be usable. Contact your local sales office for more details.
- When unbalanced torque is generated, such as in a vertical lift machine, it is recommended that the unbalanced torque of the machine be kept under 70% of the motor's rated torque.



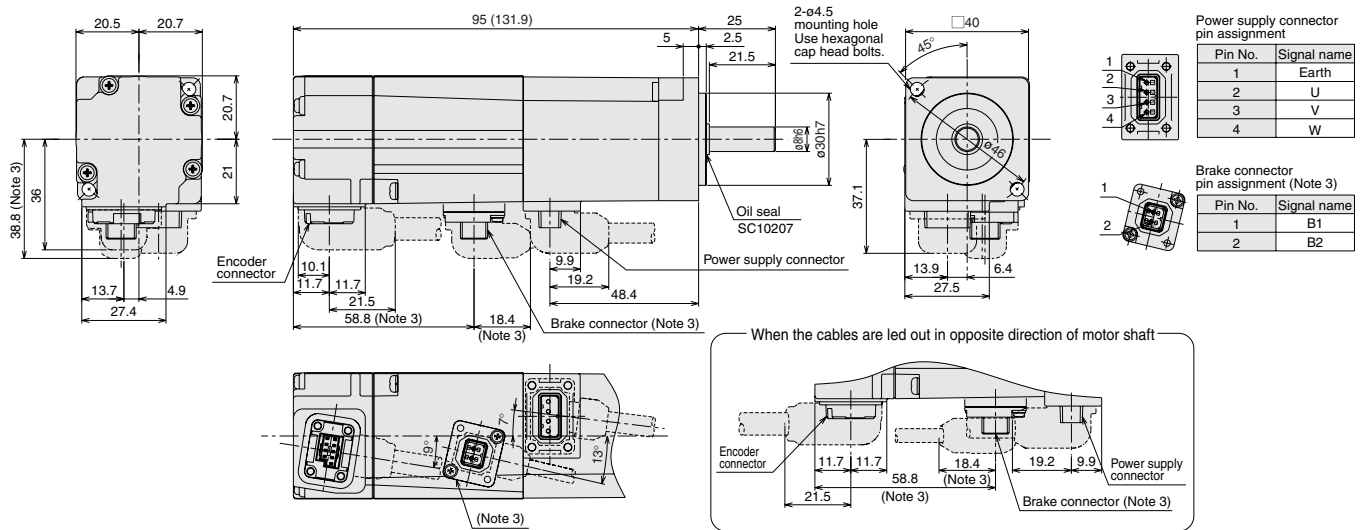
HF-SN series servo motor torque characteristics



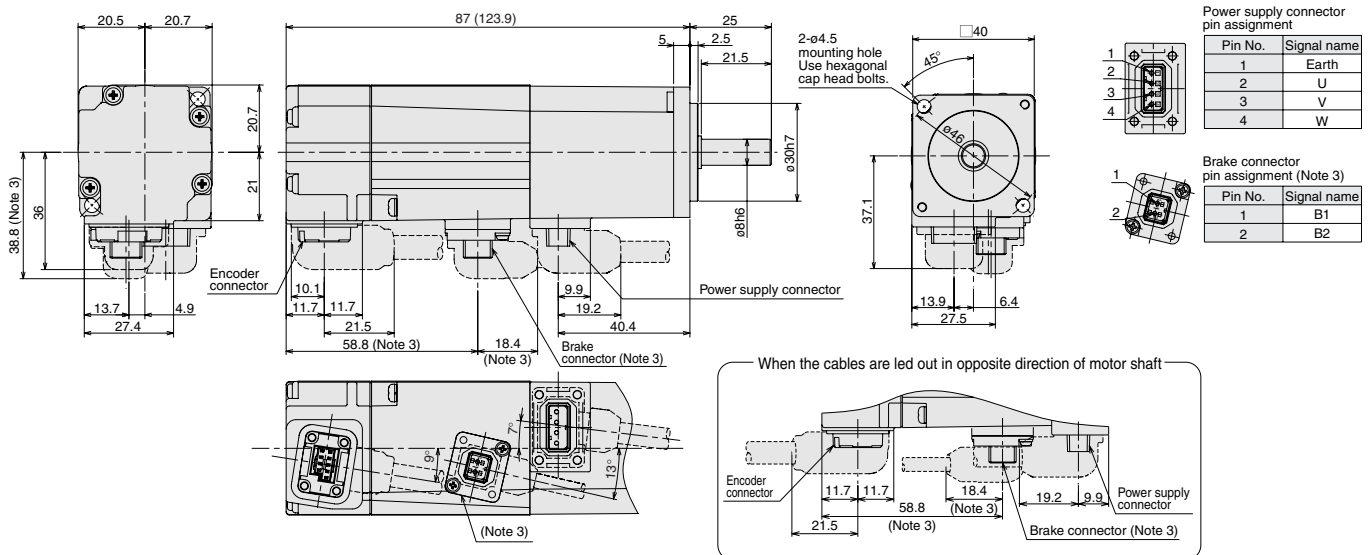
Servo Motor Dimensions

●HF-KN13(B)J

(Unit: mm)



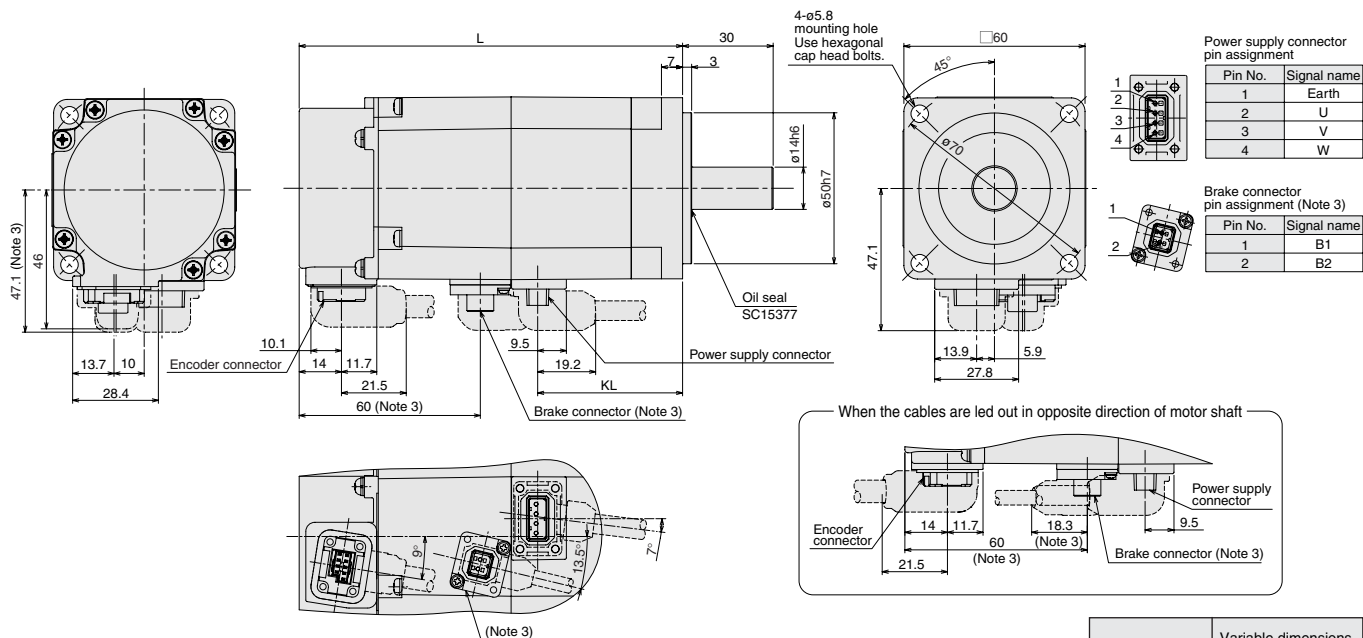
●HF-KN13(B)



- Notes: 1. Use a friction coupling to fasten a load.
 2. Dimensions inside () are for the models with an electromagnetic brake.
 3. Only for the models with an electromagnetic brake. The electromagnetic brake terminals (B1, B2) do not have polarity.
 4. For dimensions where there is no tolerance listed, use general tolerance.

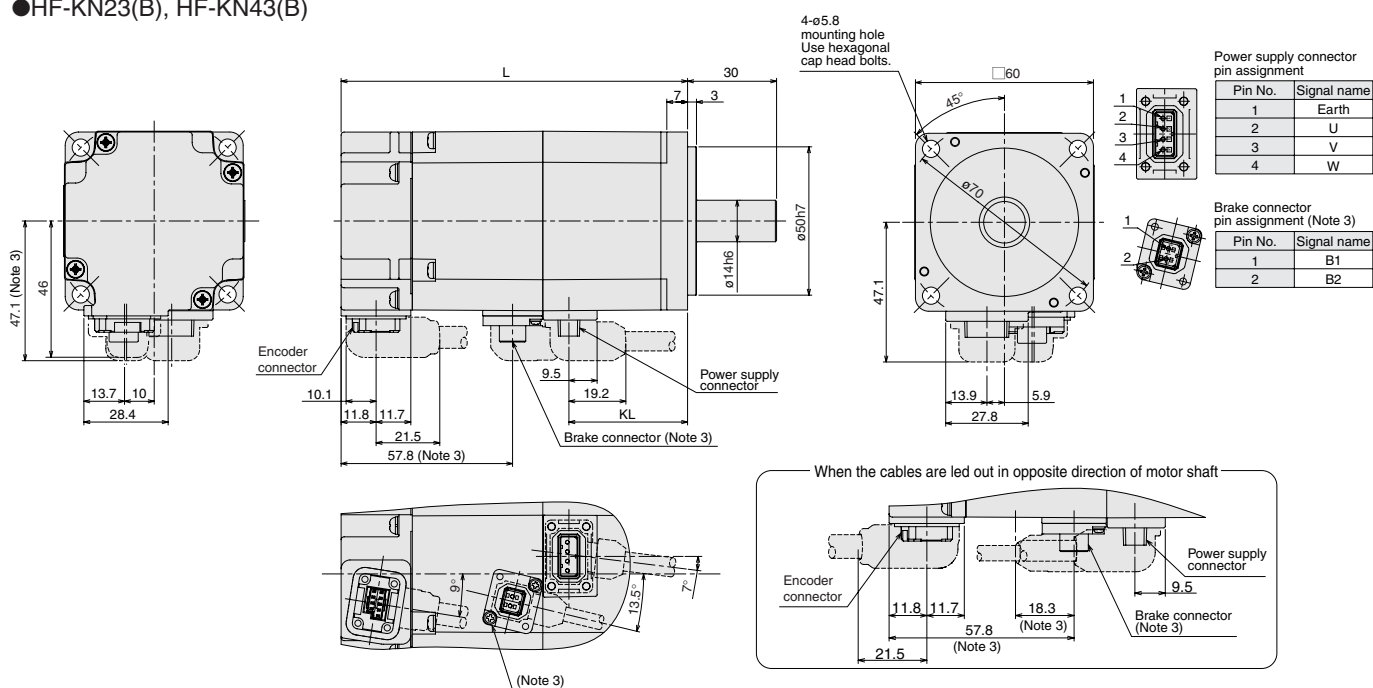
●HF-KN23(B)J, HF-KN43(B)J

(Unit: mm)



Model	Variable dimensions	
	L	KL
HF-KN23(B)J	98.4 (127)	48
HF-KN43(B)J	120.4 (149)	70

●HF-KN23(B), HF-KN43(B)



Model	Variable dimensions	
	L	KL
HF-KN23(B)	88.2 (116.8)	40
HF-KN43(B)	110.2 (138.8)	62

Notes: 1. Use a friction coupling to fasten a load.

2. Dimensions inside () are for the models with an electromagnetic brake.

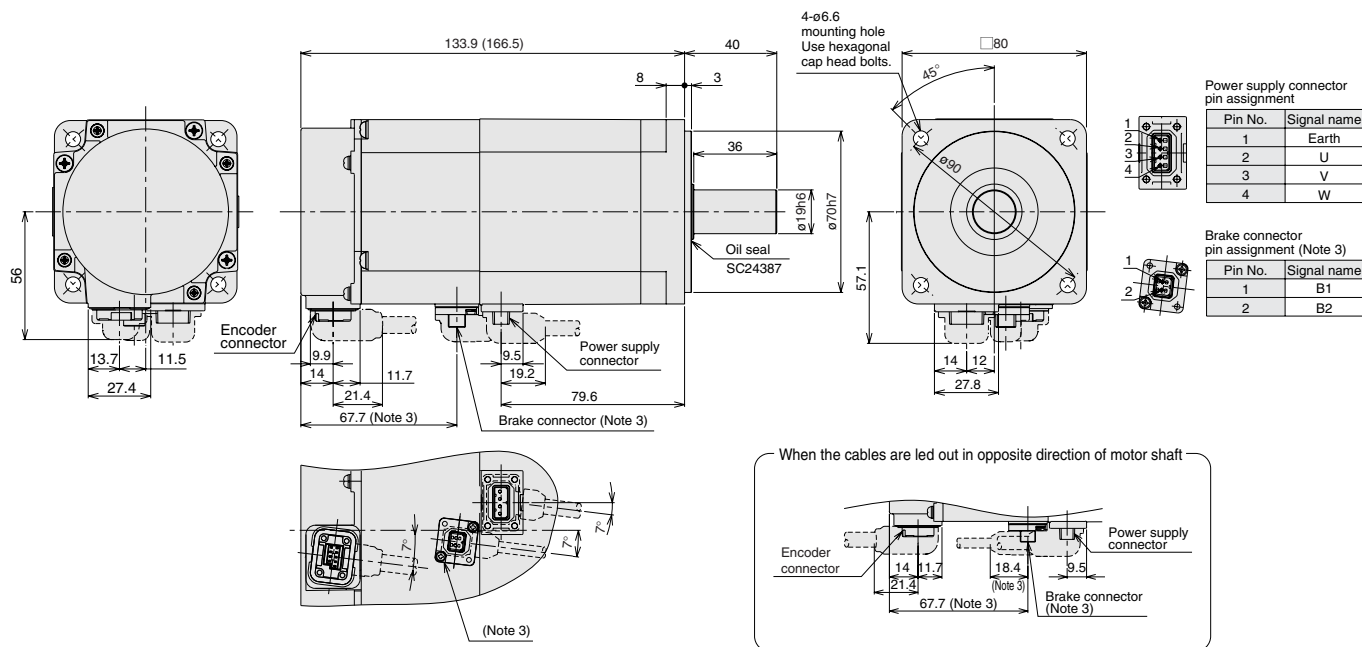
3. Only for the models with an electromagnetic brake. The electromagnetic brake terminals (B1, B2) do not have polarity.

4. For dimensions where there is no tolerance listed, use general tolerance.

Servo Motor Dimensions

●HF-KN73(B)J

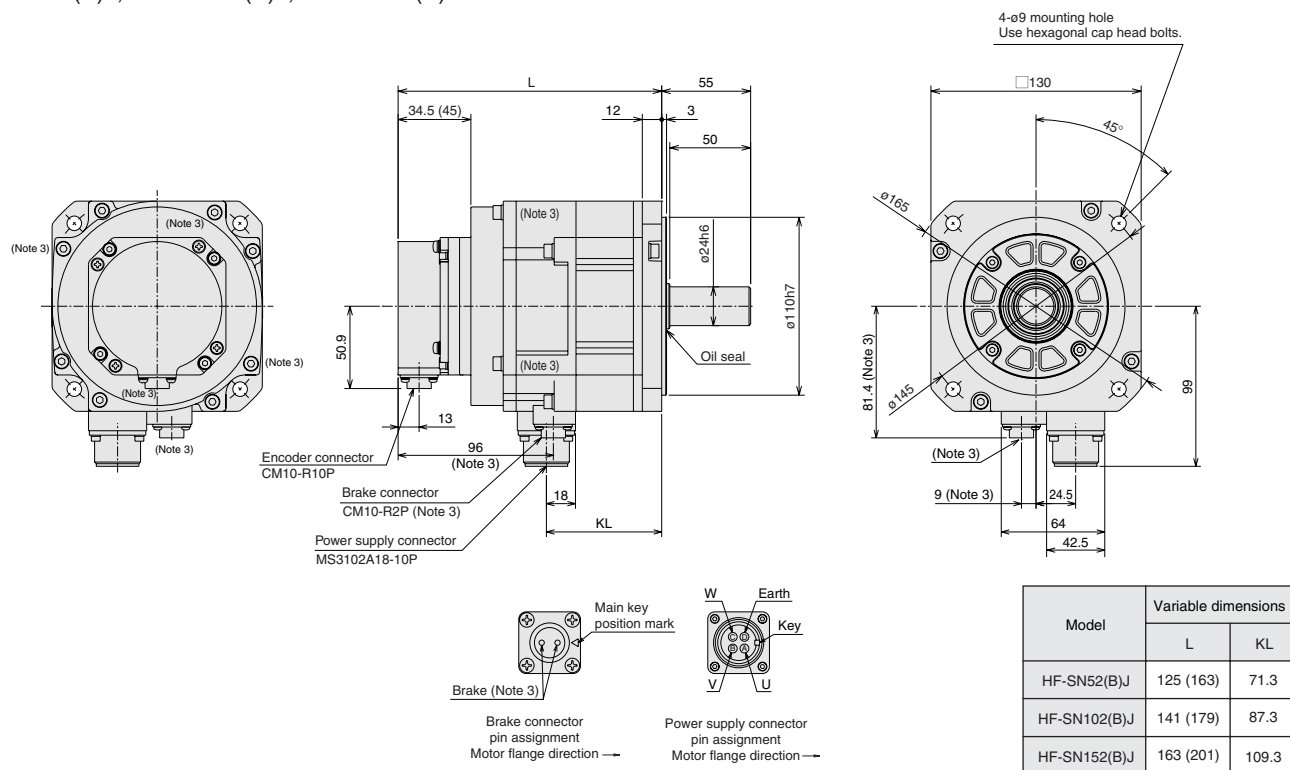
(Unit: mm)



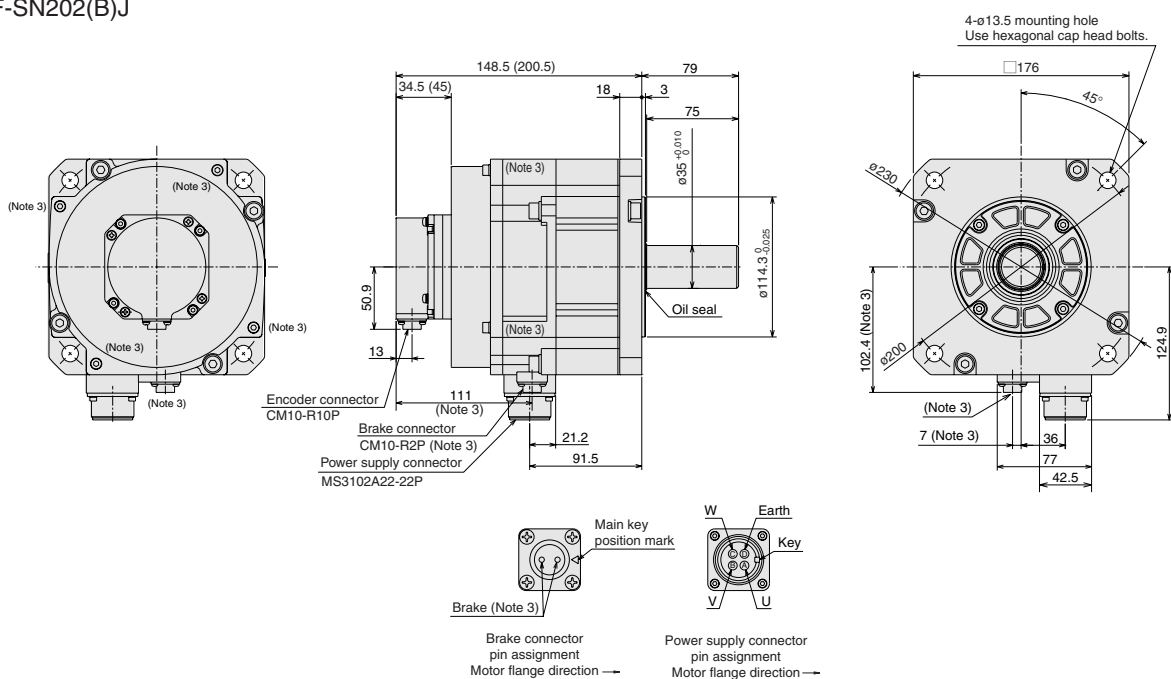
- Notes:
1. Use a friction coupling to fasten a load.
 2. Dimensions inside () are for the models with an electromagnetic brake.
 3. Only for the models with an electromagnetic brake. The electromagnetic brake terminals (B1, B2) do not have polarity.
 4. For dimensions where there is no tolerance listed, use general tolerance.

●HF-SN52(B)J, HF-SN102(B)J, HF-SN152(B)J

(Unit: mm)



●HF-SN202(B)J



- Notes: 1. Use a friction coupling to fasten a load.
2. Dimensions inside () are for the models with an electromagnetic brake.
3. Only for the models with an electromagnetic brake. The electromagnetic brake terminals do not have polarity.
4. For dimensions where there is no tolerance listed, use general tolerance.

Servo Motor Special Specifications

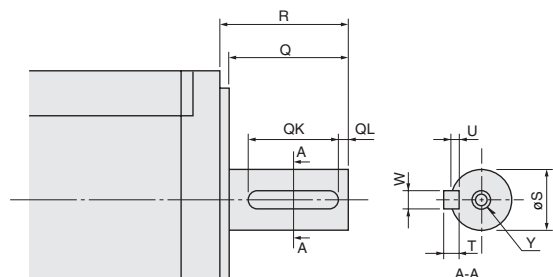
Special shaft end specifications

Servo motors with the following specifications are available.

HF-KN series

● Key shaft (with key) (200, 400, 750W) (Note 1)

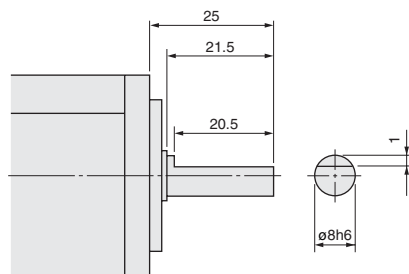
Servo motor model	Variable dimensions								
	T	S	R	Q	W	QK	QL	U	Y
HF-KN23(B)JK HF-KN43(B)JK	5	14h6	30	27	5	20	3	3	M4 screw Depth: 15mm
HF-KN73(B)JK	6	19h6	40	37	6	25	5	3.5	M5 screw Depth: 20mm



(Unit: mm)

● D-cut shaft (100W) (Note 1)

HF-KN13(B)JD

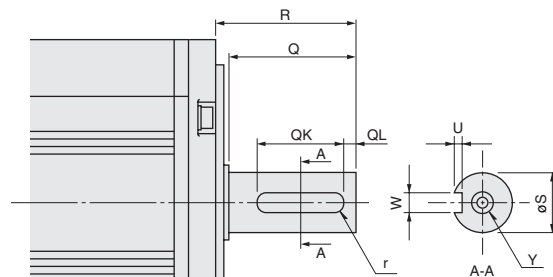


(Unit: mm)

HF-SN series

● Key shaft (without key) (Note 1, 2)

Servo motor model	Variable dimensions								
	S	R	Q	W	QK	QL	U	r	Y
HF-SN52(B)JK HF-SN102(B)JK HF-SN152(B)JK	24h6	55	50	8 ⁰ _{-0.036}	36	5	4 ^{+0.2} ₀	4	M8 screw Depth: 20mm
HF-SN202(B)JK	35 ^{+0.01} ₀	79	75	10 ⁰ _{-0.036}	55	5	5 ^{+0.2} ₀	5	M8 screw Depth: 20mm



(Unit: mm)

Notes: 1. The servo motors with key shaft (with/without key) or D-cut shaft are not suitable for frequent start/stop applications. Loose keys may damage the servo motor shaft.
2. A key is not supplied with the servo motor. The key shall be installed by the user.

Electromagnetic brake specifications (Note 1)

Servo motor model		HF-KN series				HF-SN series			
		HF-KN13BJ	HF-KN23BJ	HF-KN43BJ	HF-KN73BJ	HF-SN52BJ	HF-SN102BJ	HF-SN152BJ	HF-SN202BJ
Type		Spring type safety brake				Spring type safety brake			
Rated voltage		24VDC ⁰ _{-10%}				24VDC ⁰ _{-10%}			
Brake static friction torque	(N·m)	0.32	1.3	1.3	3.0	8.5	8.5	8.5	44
	(oz·in)	45.3	184	184	425	1200	1200	1200	6230
Power consumption (W) at 20°C (68°F)		6.3	7.9	7.9	10	20	20	20	34
Permissible braking work	(J)/time	5.6	22	22	64	400	400	400	4500
	(J)/hour	56	220	220	640	4000	4000	4000	45000
Brake life (Note 2)	Number of times	20000	20000	20000	20000	20000	20000	20000	20000
	Work per braking (J)	5.6	22	22	64	200	200	200	1000

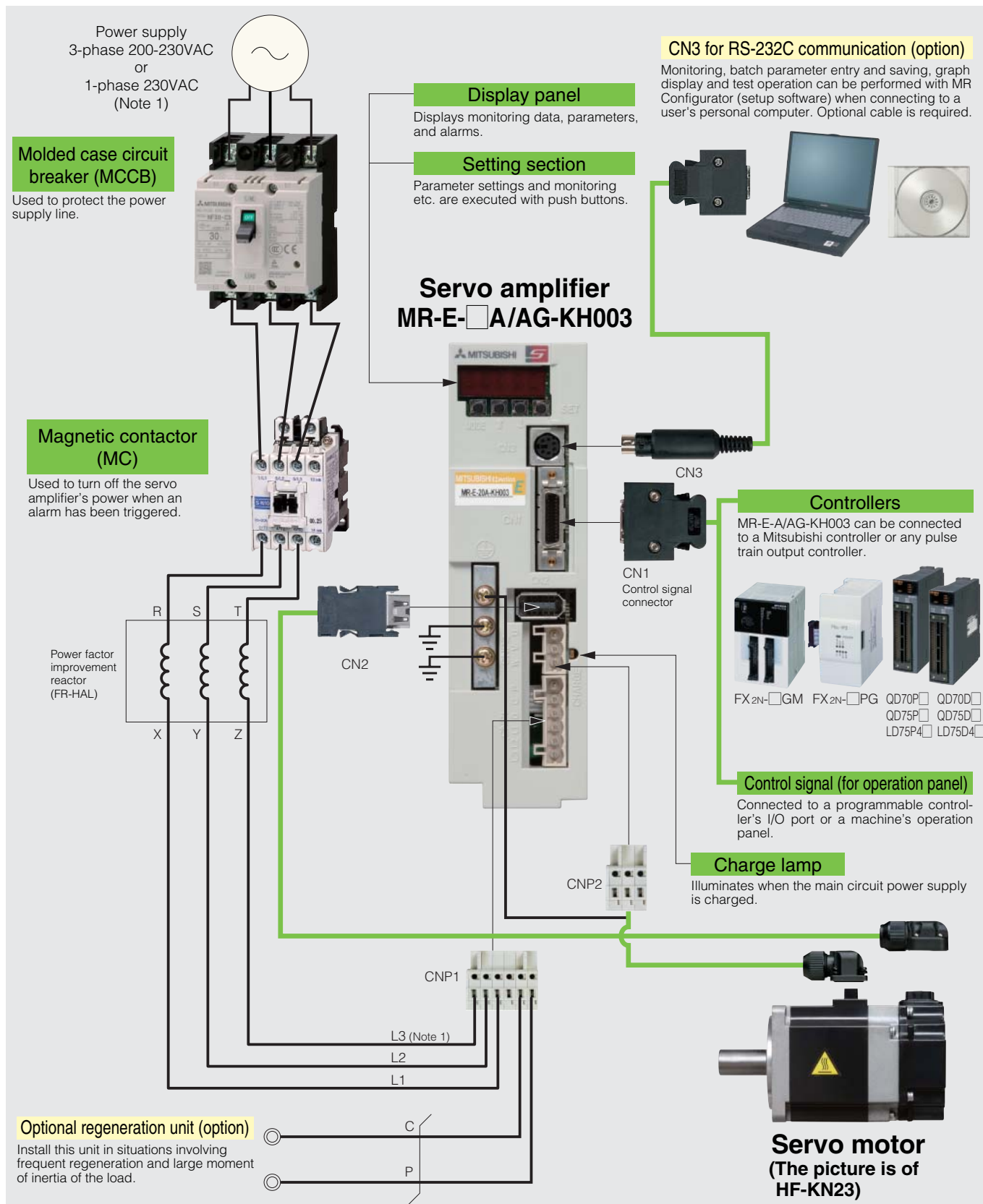
Notes: 1. The electromagnetic brake is for holding. It cannot be used for deceleration applications.
2. The brake gap cannot be adjusted. The brake life shows the time until the readjustment is needed.

Peripheral Equipment (standard interface)

Connections with peripheral equipment

Peripheral equipment is connected to MR-E Super as described below.

Connectors, options, and other necessary equipment are available so that users can set up MR-E Super easily and start using it right away.



Notes: 1. When using a power supply, 1-phase 230VAC, connect the power supply to L1 and L2 terminals. Do not connect anything to L3.

Servo Amplifier Specifications

MR-E-A-KH003

Servo amplifier model MR-E-□-KH003		10A	20A	40A	70A	100A	200A
Power supply	Voltage/frequency (Note 1)	3-phase 200 to 230VAC 50/60Hz or 1-phase 230VAC 50/60Hz				3-phase 200 to 230VAC 50/60Hz	
	Permissible voltage fluctuation	For 3-phase 200 to 230VAC: 3-phase 170 to 253VAC For 1-phase 230VAC: 1-phase 207 to 253VAC				3-phase 170 to 253VAC	
	Permissible frequency fluctuation	±5% maximum					
Control system		Sine-wave PWM control/current control system					
Dynamic brake		Built-in					
Built-in regenerative resistor		None		Installed			
Safety features		Overcurrent shutdown, regeneration overvoltage shutdown, overload shutdown (electronic thermal), encoder fault protection, regeneration fault protection, undervoltage/sudden power outage protection, overspeed protection, excess error protection					
Position control mode	Maximum input pulse frequency	1Mpps (when using differential receiver), 200 kpps (when using open collector)					
	Positioning feedback pulse	Encoder resolution: 131072 p/rev					
	Command pulse multiple	Electronic gear A/B multiple, A: 1 to 65535, B: 1 to 65535, 1/50 < A/B < 500					
	Positioning complete width setting	0 to ±10000 pulses (command pulse unit)					
	Excess error	±2.5 rotations					
	Torque limit	Set by parameters					
Speed control mode	Speed control range	Internal speed command 1:5000					
	Speed fluctuation rate	±0.01% maximum (load fluctuation 0 to 100%) 0% (power fluctuation ±10%)					
	Torque limit	Set by parameters					
Structure (IP rating)		Natural-cooling open (IP00)					Fan cooling open (IP00)
Environment	Ambient temperature	0 to 55°C (32 to 131°F) (non freezing), storage: -20 to 65°C (-4 to 149°F) (non freezing)					
	Ambient humidity	90% RH maximum (non condensing), storage: 90% RH maximum (non condensing)					
	Atmosphere	Indoors (no direct sunlight); no corrosive gas, inflammable gas, oil mist or dust					
	Elevation	1000m or less above sea level					
	Vibration	5.9m/s² or less at 10 to 55Hz (directions of X, Y and Z axes)					
Mass	(kg [lb])	0.7 (1.6)	0.7 (1.6)	1.1 (2.5)	1.7 (3.8)	1.7 (3.8)	2.0 (4.4)

MR-E-AG-KH003

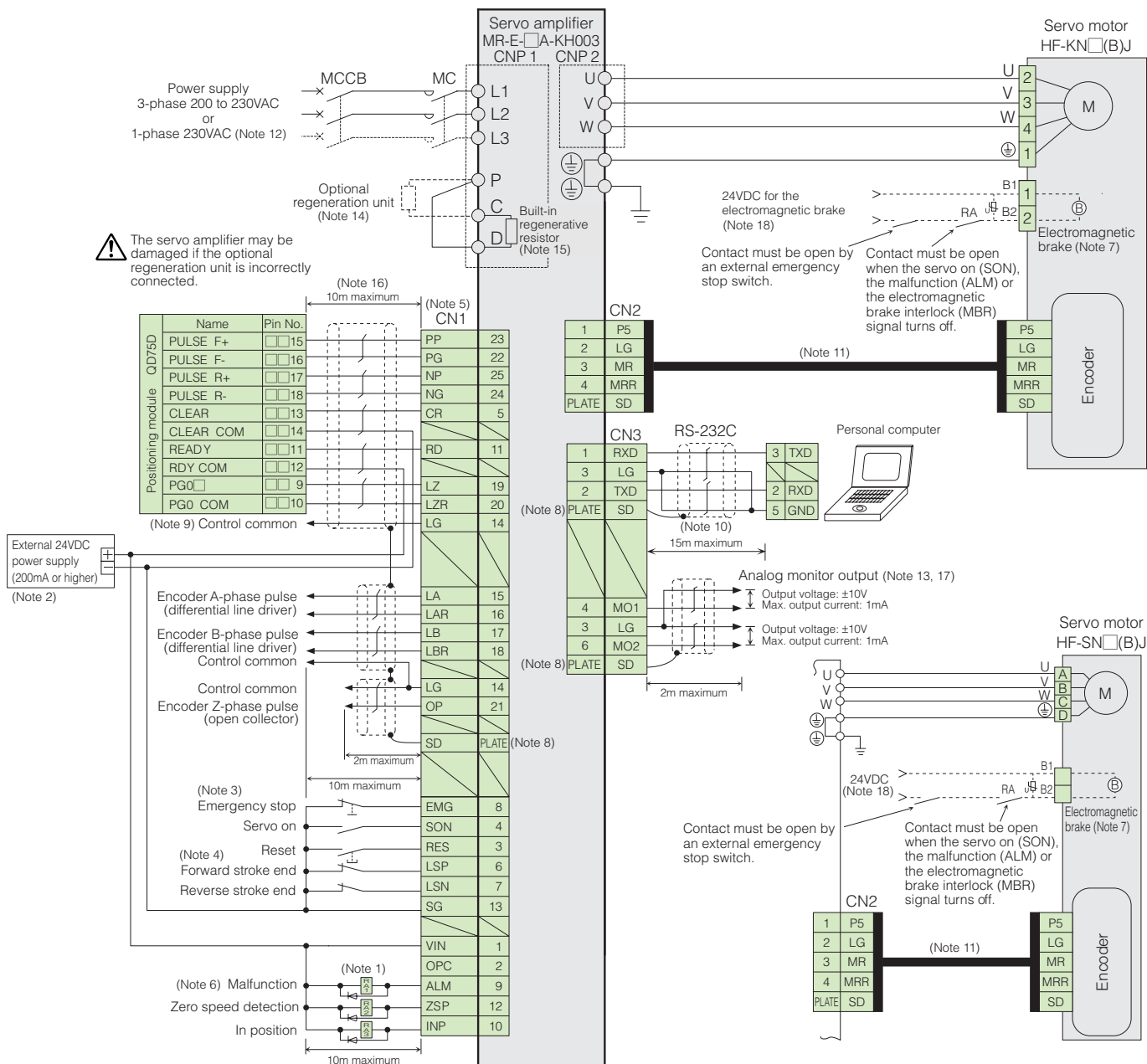
Servo amplifier model MR-E-□-KH003		10AG	20AG	40AG	70AG	100AG	200AG
Power supply	Voltage/frequency (Note 1)	3-phase 200 to 230VAC 50/60Hz or 1-phase 230VAC 50/60Hz				3-phase 200 to 230VAC 50/60Hz	
	Permissible voltage fluctuation	For 3-phase 200 to 230VAC: 3-phase 170 to 253VAC For 1-phase 230VAC: 1-phase 207 to 253VAC				3-phase 170 to 253VAC	
	Permissible frequency fluctuation	±5% maximum					
Control system		Sine-wave PWM control/current control system					
Dynamic brake		Built-in					
Built-in regenerative resistor		None		Installed			
Safety features		Overcurrent shutdown, regeneration overvoltage shutdown, overload shutdown (electronic thermal), encoder fault protection, regeneration fault protection, undervoltage/sudden power outage protection, overspeed protection, excess error protection					
Speed control mode	Speed control range	Analog speed command 1:2000, internal speed command 1:5000					
	Analog speed command input	0 to ±10VDC/rated speed					
	Speed fluctuation rate	±0.01% maximum (load fluctuation 0 to 100%) 0% (power fluctuation ±10%) ±0.2% maximum (ambient temperature 25±10°C [59 to 95°F]), when using analog speed command					
	Torque limit	Set by parameters or external analog input (0 to +10VDC/maximum torque)					
Torque control mode	Analog torque command input	0 to ±8VDC/maximum torque (input impedance 10 to 12kΩ)					
	Speed limit	Set by parameters or external analog input (0 to ±10VDC/rated speed)					
Structure (IP rating)		Natural-cooling open (IP00)					Fan cooling open (IP00)
Environ- ment	Ambient temperature	0 to 55°C (32 to 131°F) (non freezing), storage: -20 to 65°C (-4 to 149°F) (non freezing)					
	Ambient humidity	90% RH maximum (non condensing), storage: 90% RH maximum (non condensing)					
	Atmosphere	Indoors (no direct sunlight); no corrosive gas, inflammable gas, oil mist or dust					
	Elevation	1000m or less above sea level					
	Vibration	5.9m/s² or less at 10 to 55Hz (directions of X, Y and Z axes)					
Mass	(kg [lb])	0.7 (1.6)	0.7 (1.6)	1.1 (2.5)	1.7 (3.8)	1.7 (3.8)	2.0 (4.4)

Notes: 1. Rated output and speed of a servo motor are applicable when the servo amplifier, combined with the servo motor, is operated within the specified power supply voltage and frequency. Torque drops when the power supply voltage is below the specified value.

Standard Wiring Diagram

MR-E-A-KH003: Position control operation

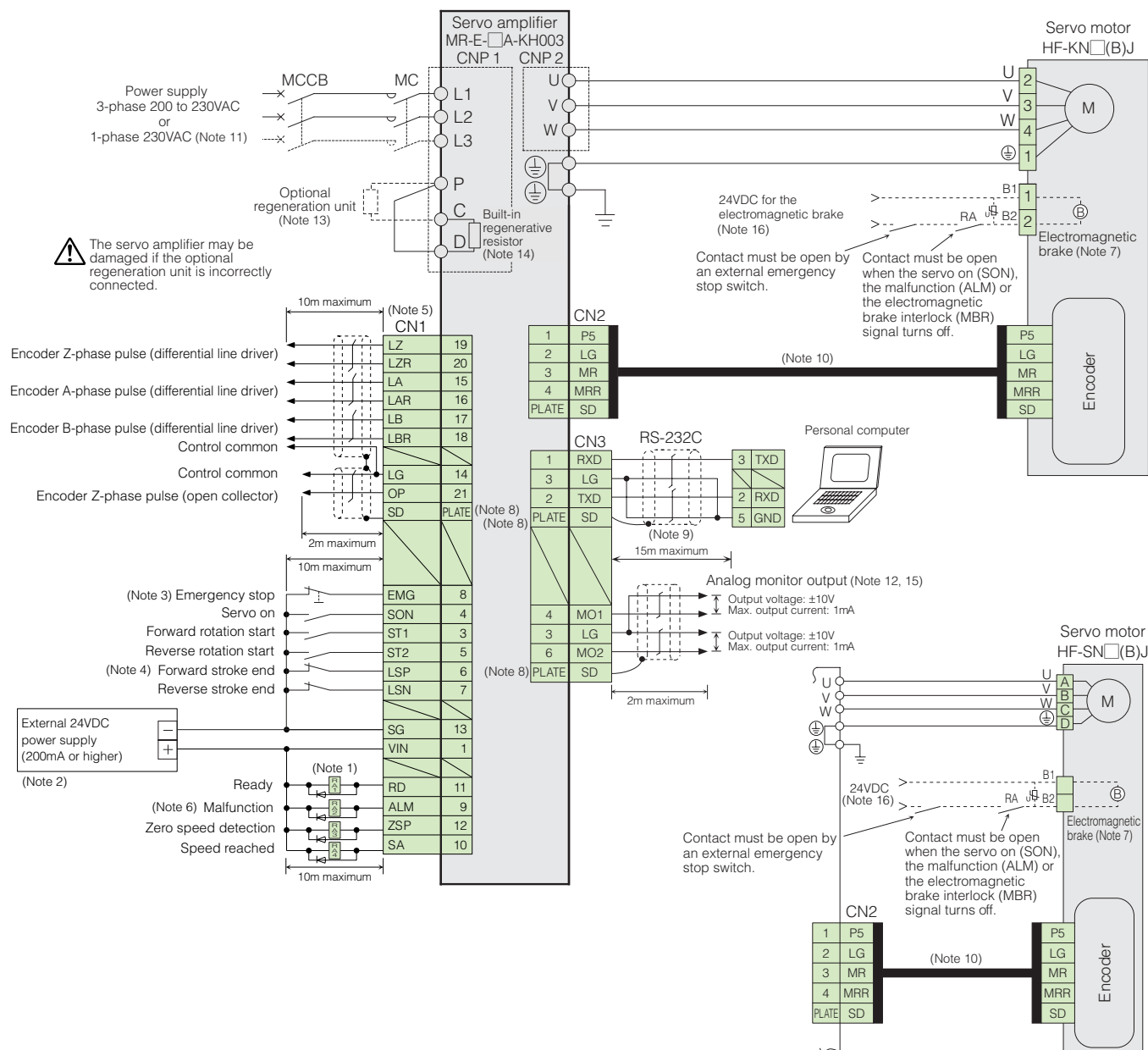
●Connection example to QD75D (position servo, incremental)



Standard Wiring Diagram

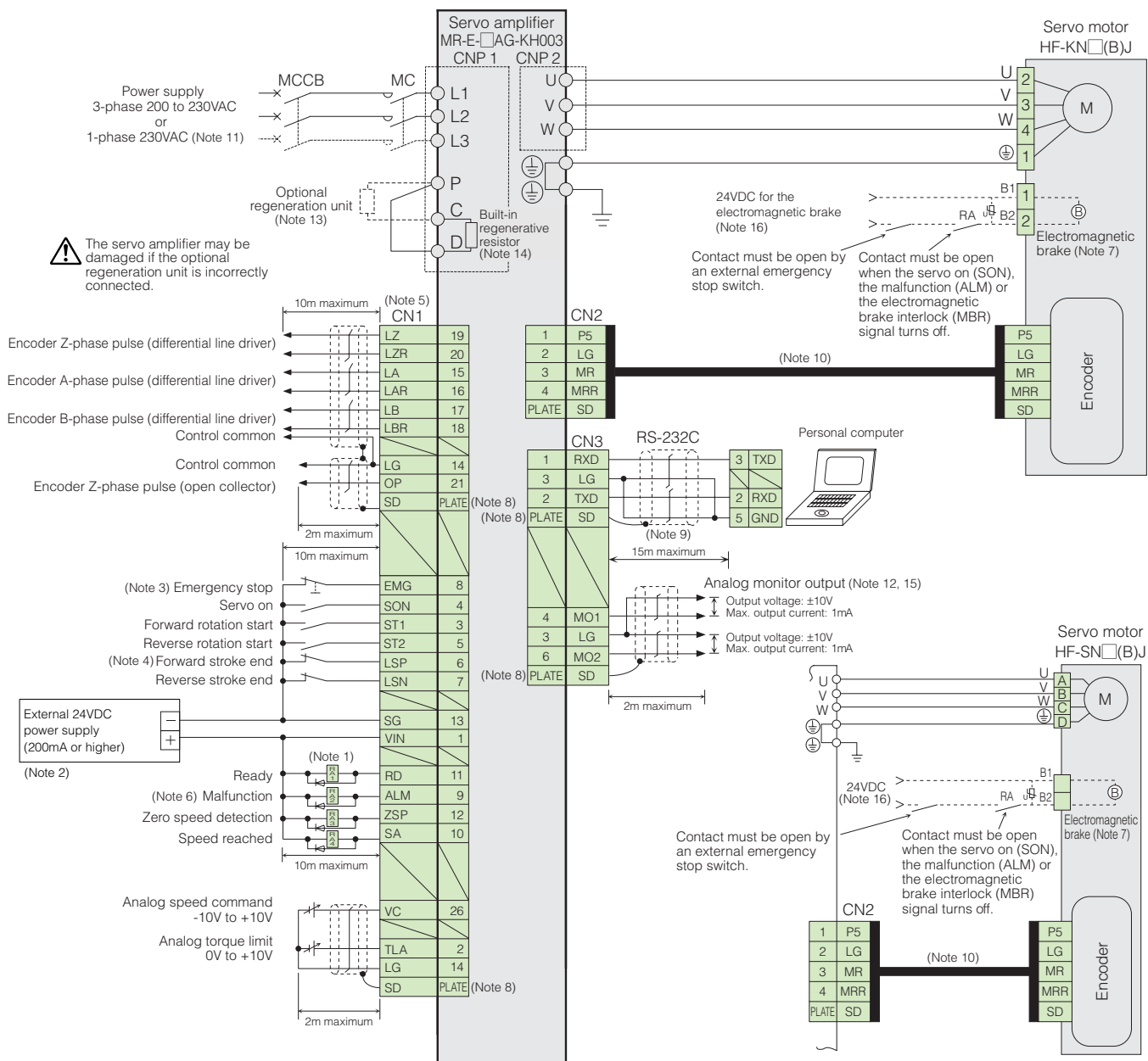
MR-E-A-KH003: Internal speed control operation

●Connection example



MR-E-AG-KH003: Speed control operation

●Connection example



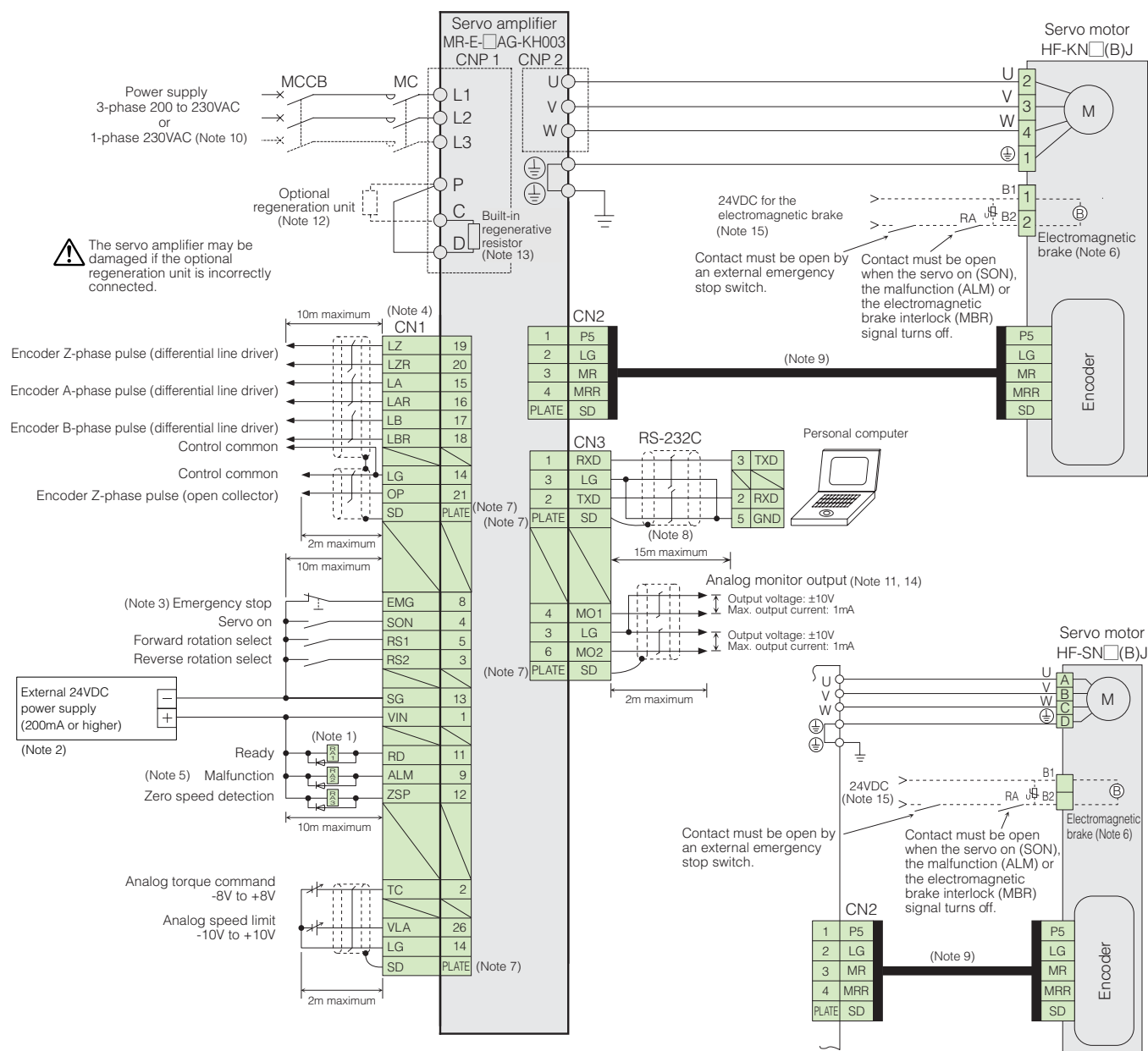
Notes:

- Do not reverse the diode's direction. Connecting it backwards may cause the servo amplifier to malfunction such that signals are not output, and emergency stop and other safety circuits are inoperable.
- Provide a 24VDC $\pm 10\%$ 200mA power supply from an external source for the interface. 200mA is the value when all input/output signals are used. Note that the current capacity can be stepped down according to the number of input/output points in use.
- Always turn on the emergency stop (EMG) signal (normally closed contact) before starting the operation. If not, the operation will not start.
- Always turn on the forward and reverse stroke end (LSP, LSN) signals (normally closed contact) before starting the operation. If not, the commands will not be accepted.
- Signals with the same name are connected internally.
- The malfunction (ALM) signal (normally closed contact) is conducted to SG in normal alarm-free condition.
- The electromagnetic brake terminals (B1, B2) do not have polarity.
- Connect the shielded wire securely to the plate inside the connector (ground plate).
- A shielded multicore cable must be used. The cable length up to 15m is possible in a low noise environment. However, if the RS-232C communication is set up with a baud rate of more than 38400bps, keep the cable length within 3m.
- The signals shown are applicable when using a two-wire type encoder cable. 30m or longer encoder cable is available in four-wire type.
- When using a 1-phase 230VAC, connect the power supply to L1 and L2 terminals. Do not connect anything to L3. The 1-phase 230VAC power supply is available only for MR-E-70AG-KH003 or smaller servo amplifier.
- Use the analog monitor/RS-232C branch cable (MR-E3CBL15-P) when connecting the analog monitor output (MO1, MO2) signals and a personal computer at the same time.
- Disconnect P and D when connecting the optional regeneration unit externally.
- Connect P and D when using the built-in regenerative resistor.
- Output voltage range varies depending on the monitored signal.
- Do not use the 24VDC interface power supply for the electromagnetic brake. Provide a power supply designed exclusively for the electromagnetic brake.

Standard Wiring Diagram

MR-E-AG-KH003: Torque control operation

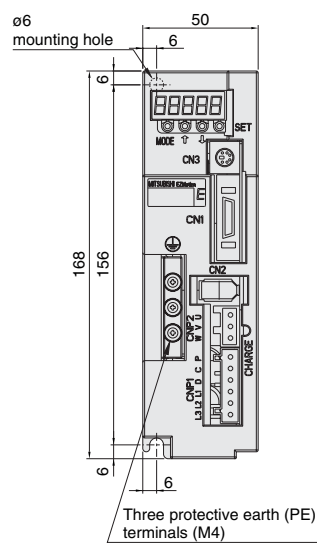
●Connection example



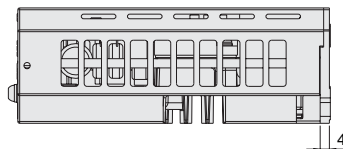
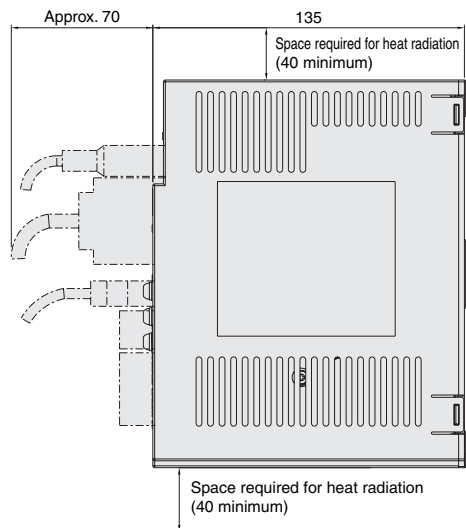
Servo Amplifier Dimensions

●MR-E-10A/AG-KH003, 20A/AG-KH003

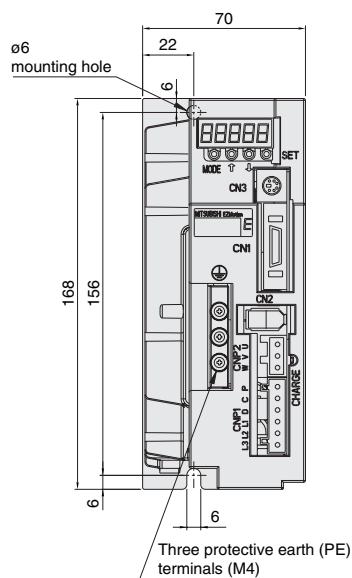
(Unit: mm)



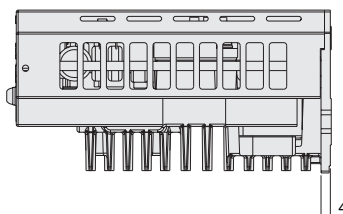
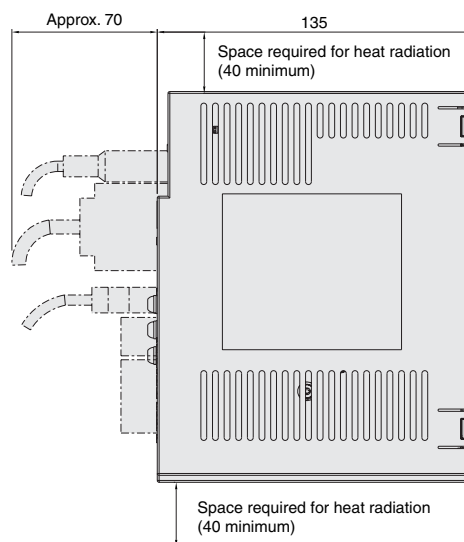
Mounting screw size: M5



●MR-E-40A/AG-KH003



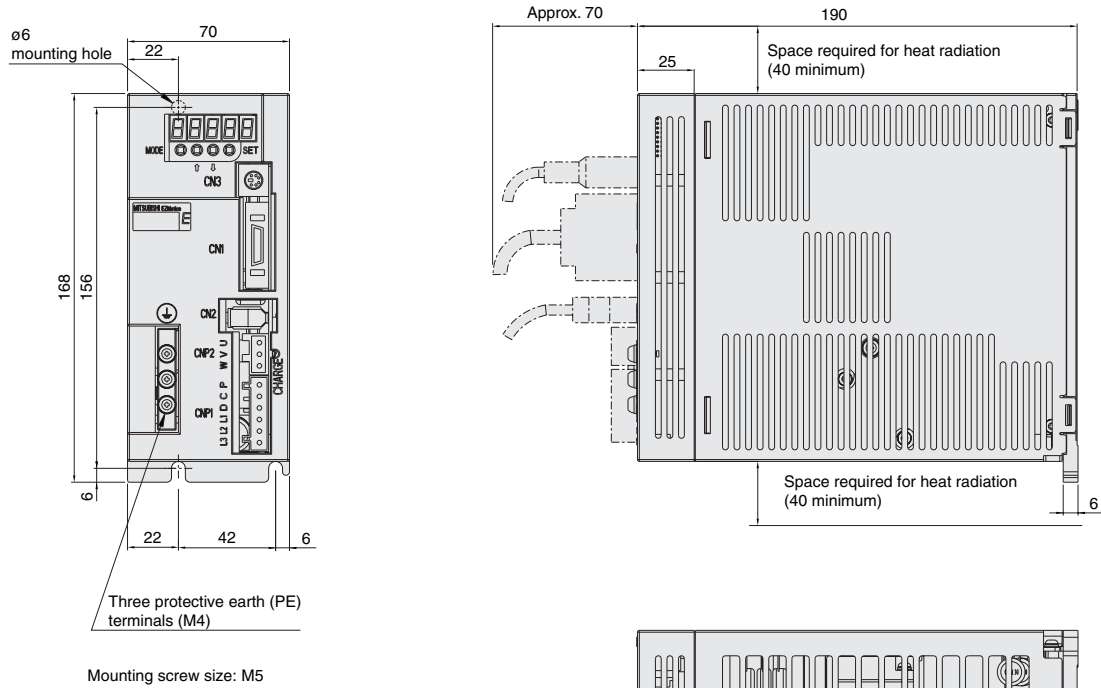
Mounting screw size: M5



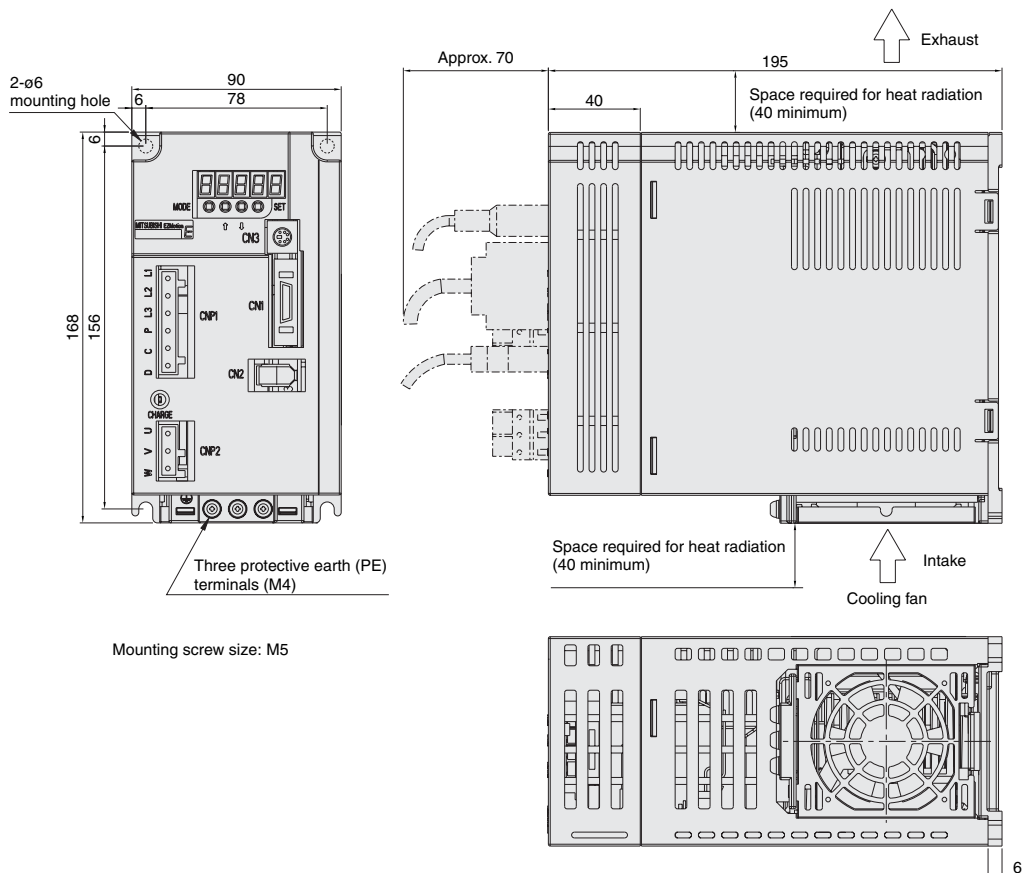
Servo Amplifier Dimensions

●MR-E-70A/AG-KH003, 100A/AG-KH003

(Unit: mm)



●MR-E-200A/AG-KH003



Options

● Optional regeneration unit (Note 1)

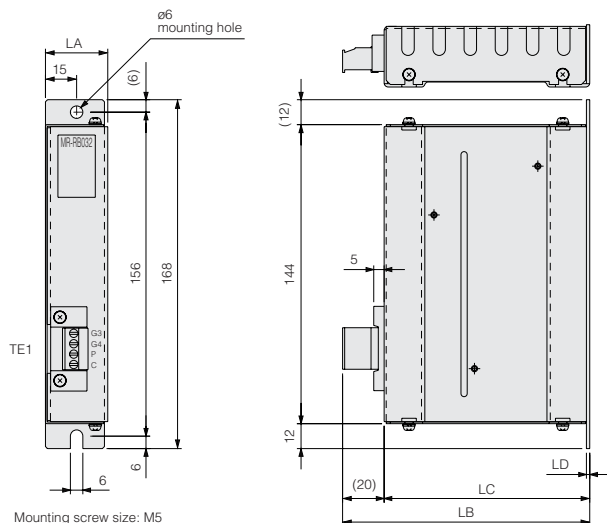
Servo amplifier model	Tolerable regenerative power of built-in regenerative resistor (W)	Tolerable regenerative power of optional regeneration unit (W) (Note 3)				
		MR-RB032 [40Ω]	MR-RB12 [40Ω]	MR-RB30 [13Ω]	MR-RB32 [40Ω]	MR-RB50 [13Ω] (Note 2)
MR-E-10A/AG-KH003	—	30	—	—	—	—
MR-E-20A/AG-KH003	—	30	100	—	—	—
MR-E-40A/AG-KH003	10	30	100	—	—	—
MR-E-70A/AG-KH003	20	30	100	—	300	—
MR-E-100A/AG-KH003	20	30	100	—	300	—
MR-E-200A/AG-KH003	100	—	—	300	—	500

Notes: 1. Connect the optional regeneration unit referring to "MR-E-□A/AG-KH003 INSTRUCTION MANUAL".

2. Be sure to cool the unit forcibly with a cooling fan (92×92mm, minimum air flow: 1.0m³/min). The cooling fan must be prepared by user.

3. The power values in this table are resistor-generated powers, not rated powers.

● MR-RB032, MR-RB12



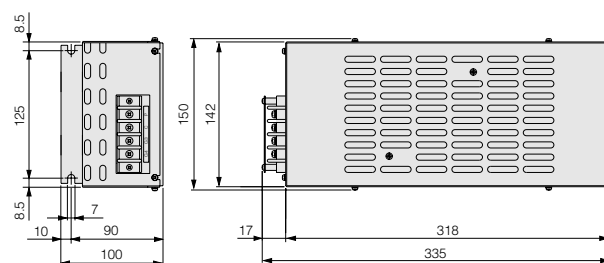
Model	Variable dimensions				Mass kg (lb)
	LA	LB	LC	LD	
MR-RB032	30	119	99	1.6	0.5 (1.1)
MR-RB12	40	169	149	2	1.1 (2.4)

<Terminal arrangement>

TE1
G3
G4
P
C

Applicable wire size:
0.2mm² (AWG24) to 2.5mm² (AWG12)

● MR-RB30, MR-RB32



Mounting screw size: M6

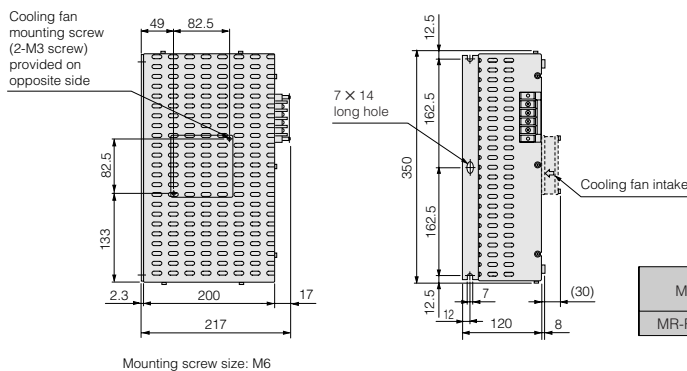
<Terminal arrangement>

P
C
G3
G4

Terminal screw size: M4

Model	Mass kg (lb)
MR-RB30	2.9 (6.4)
MR-RB32	

● MR-RB50 (Note 1)



Mounting screw size: M6

<Terminal arrangement>

P
C
G3
G4

Terminal screw size: M4

Model	Mass kg (lb)
MR-RB50	5.6 (13)

Notes: 1. When using MR-RB50, cool the unit forcibly with a cooling fan (92×92mm, minimum air flow: 1.0m³/min). The cooling fan must be prepared by user.

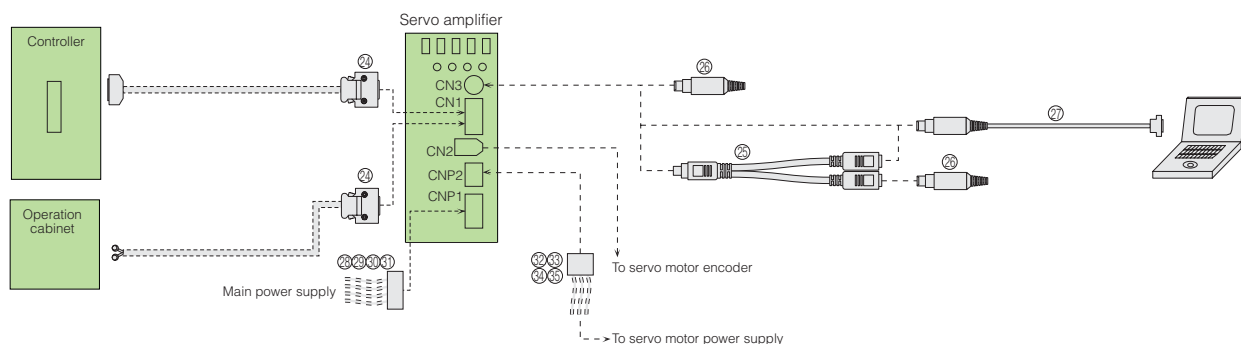
(Unit: mm)

* Cautions when connecting the optional regeneration unit.

1. The optional regeneration unit causes a temperature rise of 100°C or higher relative to the ambient temperature. Fully examine heat dissipation, installation position, wires used, etc. before installing the unit. Use flame-retardant wires or apply flame retardant on wires. Keep the wires clear of the unit.
2. Always use twisted wires, maximum length of 5m, to connect the optional regeneration unit with the servo amplifier.
3. Always use twisted wires for a thermal sensor, and make sure that the sensor does not fail to work properly due to inducted noise.

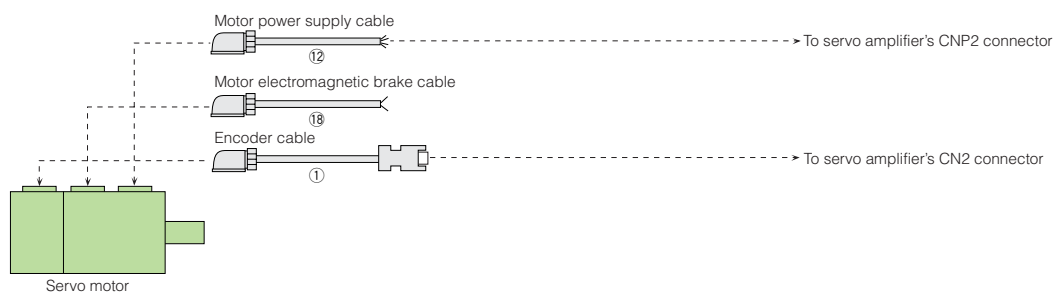
Options

● Cables and connectors

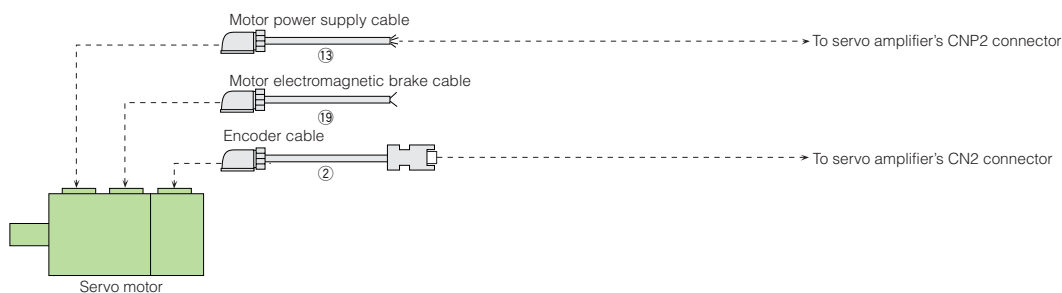


For HF-KN servo motor series: encoder cable length 10m or shorter

- For leading the cables out in a direction of the motor shaft (Note 1)



- For leading the cables out in an opposite direction of the motor shaft (Note 1)

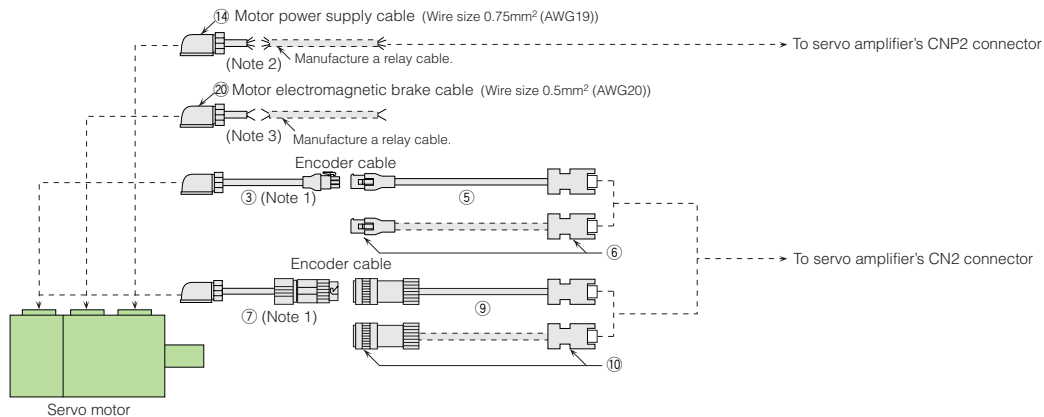


Notes: 1. Cables for leading two different directions may be used for one servo motor.

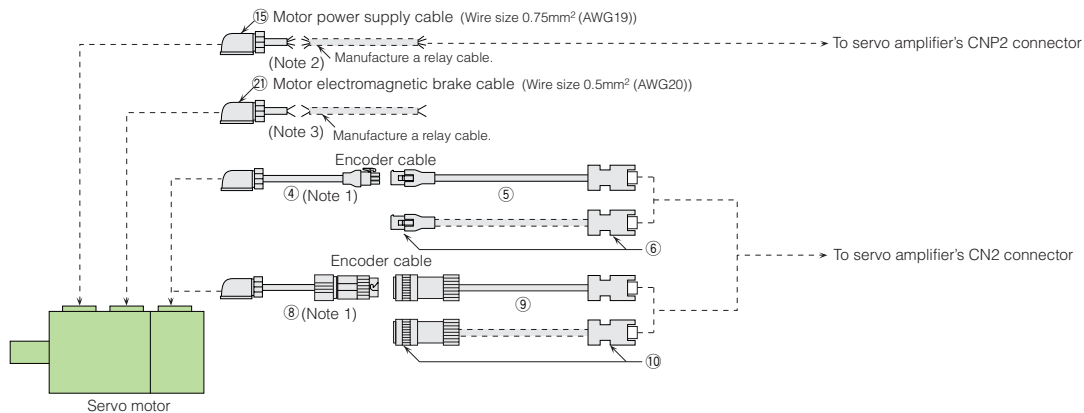
● Cables and connectors

For HF-KN servo motor series: encoder cable length over 10m

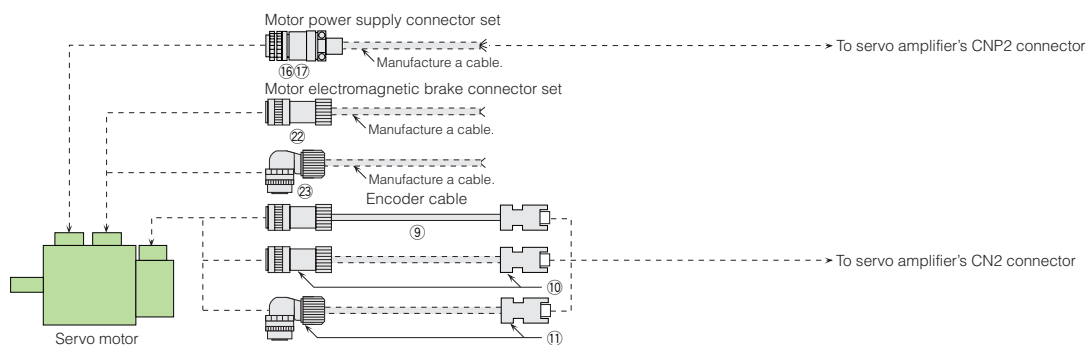
- For leading the cables out in a direction of the motor shaft (Note 4)



- For leading the cables out in an opposite direction of the motor shaft (Note 4)



For HF-SN servo motor series








Notes: 1. This cable does not have a long bending life, so always fix the cable before using.

2. If the length exceeds 10m, relay a cable using MR-PWS2CBL03M-A1-L/-A2-L cable. This cable does not have a long bending life, so always fix the cable before using.

3. If the length exceeds 10m, relay a cable using MR-BKS2CBL03M-A1-L/-A2-L cable. This cable does not have a long bending life, so always fix the cable before using.

4. Cables for leading two different directions may be used for one servo motor.

● Cables and connectors

Item			Model	IP rating (Note 2)	Description
For encoder	①	10m or shorter (Direct connection type)	Encoder cable for HF-KN series Lead out in direction of motor shaft MR-J3ENCBL□M-A1-H □=cable length: 2, 5, 10m (Note 1, 3)	IP65	 Encoder connector (TE connectivity) 1674320-1 Amplifier connector 36210-0100PL (receptacle, 3M) 36310-3200-008 (shell kit, 3M), or 54599-1019 (connector set, Molex)
	②		Encoder cable for HF-KN series Lead out in opposite direction of motor shaft MR-J3ENCBL□M-A1-L □=cable length: 2, 5, 10m (Note 1)	IP65	
	③	Exceeding 10m (Relay type)	Motor-side encoder cable for HF-KN series Lead out in direction of motor shaft MR-J3JCBL03M-A1-L Cable length: 0.3m (Note 1)	IP20	
			Motor-side encoder cable for HF-KN series Lead out in opposite direction of motor shaft MR-J3JCBL03M-A2-L Cable length: 0.3m (Note 1)	IP20	
	⑤	Amplifier-side encoder cable for HF-KN series	MR-EKCBL□M-H □=cable length: 20, 30, 40, 50m (Note 1, 3, 6)	IP20	 Junction connector (TE connectivity) 1-172161-9 (housing) 170359-1 (connector pin) MTI-0002 (cable clamp, TOA ELECTRIC INDUSTRIAL) Amplifier connector 36210-0100PL (receptacle, 3M) 36310-3200-008 (shell kit, 3M), or 54599-1019 (connector set, Molex)
			MR-EKCBL□M-L □=cable length: 20, 30m (Note 1, 6)	IP20	
	⑥	Exceeding 10m (Relay type)	Junction connector set for HF-KN series MR-ECNM	IP20	 Junction connector (TE connectivity) 1-172161-9 (housing) 170359-1 (connector pin) MTI-0002 (cable clamp, TOA ELECTRIC INDUSTRIAL) Amplifier connector 36210-0100PL (receptacle, 3M) 36310-3200-008 (shell kit, 3M), or 54599-1019 (connector set, Molex) <Applicable cable example> Wire size: 0.3mm ² (AWG22) Completed cable outer diameter: φ8.2mm Crimping tool (91529-1) is required. Use these in combination of ③ or ④.
	⑦		Motor-side encoder cable for HF-KN series Lead out in direction of motor shaft MR-J3JSCBL03M-A1-L Cable length: 0.3m (Note 1)	IP65 (Note 5)	 Encoder connector (TE connectivity) 1674320-1 Junction connector (DDK) CM10-CR10P-M (cable receptacle)
	⑧		Motor-side encoder cable for HF-KN series Lead out in opposite direction of motor shaft MR-J3JSCBL03M-A2-L Cable length: 0.3m (Note 1)	IP65 (Note 5)	
	⑨	Encoder cable for HF-KN/HF-SN series	MR-J3ENSCBL□M-H □=cable length: 2, 5, 10, 20, 30, 40, 50m (Note 1, 3, 4)	IP67	 Amplifier connector 36210-0100PL (receptacle, 3M) 36310-3200-008 (shell kit, 3M), or 54599-1019 (connector set, Molex) Encoder connector (DDK) <For 10m or shorter cable> CM10-SP10S-M (D6) (straight plug) CM10-#22SC(C1) (D8)-100 (socket contact) <For exceeding 10m> CM10-SP10S-M (D6) (straight plug) CM10-#22SC(C2) (D8)-100 (socket contact) Use these in combination of ⑦ or ⑧ for HF-KN series.
			MR-J3ENSCBL□M-L □=cable length: 2, 5, 10, 20, 30m (Note 1, 4)	IP67	

Notes: 1. -H and -L indicate a bending life. -H indicates a long bending life, and -L indicates a standard bending life.

2. The IP rating indicated is for the connector's protection against ingress of dust and water when coupled to a servo amplifier/servo motor. If the IP rating of the servo amplifier/servo motor differs from that of these connectors, overall IP rating depends on the lowest of all.

3. For the ultra-long bending life cables and/or for unlisted lengths (available in the ultra-long bending life cables), contact Mitsubishi Electric System & Service Co., Ltd. FA PRODUCT DIVISION by email: oss-ip@melsc.jp

4. Select from below if there is a potential risk that a high vibration may be applied to connectors.

Encoder cable: MR-J3ENSCBL□M-H-S06 (long bending life) or MR-J3ENSCBL□M-L-S06 (standard bending life)


Encoder connector set: MR-J3SCNS-S06 (straight type) or MR-J3SCNSA-S06 (angled type)

Connector cover: MR-J3ENS-CVR (straight type) or MR-J3ENSA-CVR (angled type)



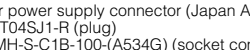
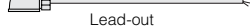



Be sure to use this connector cover when using the encoder cable or the encoder connector set in the table.

Contact your local sales office for more details.

5. The encoder cable is rated IP65 while the junction connector is rated IP67.

6.  are available in four-wire type. Parameter setting is required to use the four-wire type encoder cable.

● Cables and connectors

Item				Model	IP rating (Note 2)	Description
For encoder	⑩	Encoder connector set for HF-KN/HF-SN series		MR-J3SCNS (Note 4)	IP67	 Amplifier connector 36210-0100PL (receptacle, 3M) 36310-3200-008 (shell kit, 3M), or 54599-1019 (connector set, Molex) Encoder connector (DDK) CM10-SP10S-M (D6) (straight plug) CM10-#22SC(S1) (D8)-100 (socket contact) <Applicable cable example> Wire size: 0.5mm ² (AWG20) or smaller Completed cable outer diameter: φ6.0mm to φ9.0mm Use these in combination of ⑦ or ⑧ for HF-KN series.
	⑪	Encoder connector set for HF-SN series		MR-J3SCNSA (Note 4)	IP67	 Amplifier connector 36210-0100PL (receptacle, 3M) 36310-3200-008 (shell kit, 3M), or 54599-1019 (connector set, Molex) Encoder connector (DDK) CM10-AP10S-M(D6) (angled plug) CM10-#22SC(S1)(D8)-100 (socket contact) <Applicable cable example> Wire size: 0.5mm ² (AWG20) or smaller Completed cable outer diameter: φ6.0mm to φ9.0mm
For servo motor power supply	⑫	10m or shorter (Direct connection type)	Power supply cable for HF-KN series Lead out in direction of motor shaft	MR-PWS1CBL□M-A1-H □=cable length: 2, 5, 10m (Note 1, 3)	IP65	 Motor power supply connector (Japan Aviation Electronics Industry) JN4FT04SJ1-R (plug) ST-TMH-S-C1B-100-(A534G) (socket contact)
				MR-PWS1CBL□M-A1-L □=cable length: 2, 5, 10m (Note 1)	IP65	
	⑬	10m or shorter (Direct connection type)	Power supply cable for HF-KN series Lead out in opposite direction of motor shaft	MR-PWS1CBL□M-A2-H □=cable length: 2, 5, 10m (Note 1, 3)	IP65	 Lead-out *The cable is not shielded.
				MR-PWS1CBL□M-A2-L □=cable length: 2, 5, 10m (Note 1)	IP65	
	⑭	Exceeding 10m (Relay type)	Power supply cable for HF-KN series Lead out in direction of motor shaft	MR-PWS2CBL03M-A1-L Cable length: 0.3m (Note 1)	IP55	 Motor power supply connector (Japan Aviation Electronics Industry) JN4FT04SJ2-R (plug) ST-TMH-S-C1B-100-(A534G) (socket contact)
			Power supply cable for HF-KN series Lead out in opposite direction of motor shaft	MR-PWS2CBL03M-A2-L Cable length: 0.3m (Note 1)	IP55	
	⑯	Power supply connector set for HF-SN52J, 102J, 152J		MR-PWCNS4 (Straight type)	IP67	 Motor power supply connector (DDK) CE05-6A18-10SD-D-BSS (plug) (straight) CE3057-10A-1-D (cable clamp) <Applicable cable example> Wire size: 2mm ² (AWG14) to 3.5mm ² (AWG12) Completed cable outer diameter: φ10.5mm to φ14.1mm
	⑰	Power supply connector set for HF-SN202J		MR-PWCNS5 (Straight type)	IP67	 Motor power supply connector (DDK) CE05-6A22-22SD-D-BSS (plug) (straight) CE3057-12A-1-D (cable clamp) <Applicable cable example> Wire size: 5.5mm ² (AWG10) to 8mm ² (AWG8) Completed cable outer diameter: φ12.5mm to φ16mm

Notes: 1. -H and -L indicate a bending life. -H indicates a long bending life, and -L indicates a standard bending life.

2. The IP rating indicated is for the connector's protection against ingress of dust and water when coupled to a servo amplifier/servo motor. If the IP rating of the servo amplifier/servo motor differs from that of these connectors, overall IP rating depends on the lowest of all.

3. For the ultra-long bending life cables and/or for unlisted lengths (available in the ultra-long bending life cables), contact Mitsubishi Electric System & Service Co., Ltd. FA PRODUCT DIVISION by email: oss-ip@melsc.jp

4. Select from below if there is a potential risk that a high vibration may be applied to connectors.

Encoder cable: MR-J3ENSCBL□M-H-S06 (long bending life) or MR-J3ENSCBL□M-L-S06 (standard bending life)





Encoder connector set: MR-J3SCNS-S06 (straight type) or MR-J3SCNSA-S06 (angled type)

Connector cover: MR-J3ENS-CVR (straight type) or MR-J3ENSA-CVR (angled type)

Be sure to use this connector cover when using the encoder cable or the encoder connector set in the table.













Contact your local sales office for more details.

● Cables and connectors

Item				Model	IP rating (Note 2)	Description
For servo motor electromagnetic brake	⑱	10m or shorter (Direct connection type)	Brake cable for HF-KN series Lead out in direction of motor shaft	MR-BKS1CBL□M-A1-H □=cable length: 2, 5, 10m (Note 1, 3)	IP65	 <p>Motor brake connector (Japan Aviation Electronics Industry) JN4FT02SJ1-R (plug) ST-TMH-S-C1B-100-(A534G) (socket contact)</p> <p>Lead-out</p> <p>*The cable is not shielded.</p>
				MR-BKS1CBL□M-A1-L □=cable length: 2, 5, 10m (Note 1)	IP65	
	⑲		Brake cable for HF-KN series Lead out in opposite direction of motor shaft	MR-BKS1CBL□M-A2-H □=cable length: 2, 5, 10m (Note 1, 3)	IP65	
				MR-BKS1CBL□M-A2-L □=cable length: 2, 5, 10m (Note 1)	IP65	
	⑳	Exceeding 10m (Relay type)	Brake cable for HF-KN series Lead out in direction of motor shaft	MR-BKS2CBL03M-A1-L Cable length: 0.3m (Note 1)	IP55	 <p>Motor brake connector (Japan Aviation Electronics Industry) JN4FT02SJ2-R (plug) ST-TMH-S-C1B-100-(A534G) (socket contact)</p> <p>Lead-out</p> <p>*The cable is not shielded.</p>
	㉑		Brake cable for HF-KN series Lead out in opposite direction of motor shaft	MR-BKS2CBL03M-A2-L Cable length: 0.3m (Note 1)	IP55	
	㉒	Brake connector set for HF-SN series		MR-BKCNS1 (Note 4) (Straight type)	IP67	 <p>Motor brake connector (DDK) (solder type) CM10-SP2S-L(D6)(straight plug) CM10-#22SC(S2)(D8)-100(socket contact)</p> <p><Applicable cable example> Wire size: 1.25mm² (AWG16) or smaller Completed cable outer diameter: φ9.0mm to φ11.6mm</p>
	㉓	Brake connector set for HF-SN series		MR-BKCNS1A (Note 4) (Angled type)	IP67	 <p>Motor brake connector (DDK) (solder type) CM10-AP2S-L(D6) (angled plug) CM10-#22SC(S2)(D8)-100 (socket contact)</p> <p><Applicable cable example> Wire size: 1.25mm² (AWG16) or smaller Completed cable outer diameter: φ9.0mm to φ11.6mm</p>

- Notes: 1. -H and -L indicate a bending life. -H indicates a long bending life, and -L indicates a standard bending life.
2. The IP rating indicated is for the connector's protection against ingress of dust and water when coupled to a servo amplifier/servo motor. If the IP rating of the servo amplifier/servo motor differs from that of these connectors, overall IP rating depends on the lowest of all.
3. For the ultra-long bending life cables and/or for unlisted lengths (available in the ultra-long bending life cables), contact Mitsubishi Electric System & Service Co., Ltd. FA PRODUCT DIVISION by email: oss-ip@melsc.jp
4. Select from below if there is a potential risk that a high vibration may be applied to connectors.
Brake connector set: MR-BKCNS1-S06 (straight type) or MR-BKCNS1A-S06 (angled type)
Connector cover: MR-J3ENS-CVR (straight type) or MR-J3ENSA-CVR (angled type)
Be sure to use this connector cover when using the brake connector set in the table.
Contact your local sales office for more details.

● Cables and connectors

Item			Model	IP rating	Description	
For CN1	②4	Connector set (for CN1)	MR-ECN1 (Unit: 20 pcs/box)	—		Amplifier connector (3M or an equivalent product) 10126-3000PE (connector) 10326-52F0-008 (shell kit)
	②5	Analog monitor/ RS-232C branch cable	MR-E3CBL15-P	—		RS-232C option connector (Marushin electric mfg. or an equivalent product) MP371/6 (connector) (mini-DIN 6-pin male) Analog monitor connector (Marushin electric mfg. or an equivalent product) MJ372/6 (connector) (mini-DIN 6-pin female)
For CN3	②6	Analog monitor RS-232C connector	MR-ECN3 (Unit: 20 pcs/box)	—		Analog monitor, RS-232C option connector (Marushin electric mfg. or an equivalent product) MP371/6 (connector) (mini-DIN 6-pin male)
	②7	Personal computer communication cable	QC30R2 Cable length: 3m	—		RS-232C option connector (Marushin electric mfg. or an equivalent product) MP371/6 (connector) (mini-DIN 6-pin male) DOS/4 personal computer connector (Japan Aviation Electronics Industry) DE-9SF-N (connector) DE-C1-J6-S6R (case)
Servo amplifier power supply connectors (for CNP1)	②8	Amplifier power supply connector set (press bonding type) for MR-E-10A/AG to 100A/AG-KH003	MR-ECNP1-A (Unit: 20 pcs/box)	—		Connector 51240-0600 (Molex or an equivalent product) Terminal 56125-0128 (Molex or an equivalent product)
	②9	Amplifier power supply connector (insertion type) for MR-E-10A/AG to 100A/AG-KH003	MR-ECNP1-B (Unit: 20 pcs/box)	—		Connector 54927-0610 (Molex or an equivalent product)
	③0	Amplifier power supply connector set (press bonding type) for MR-E-200A/AG-KH003	MR-ECNP1-A1 (Unit: 20 pcs/box)	—		Connector 54241-0600 (Molex or an equivalent product) Terminal 56125-0128 (Molex or an equivalent product)
	③1	Amplifier power supply connector (insertion type) for MR-E-200A/AG-KH003	MR-ECNP1-B1 (Unit: 20 pcs/box)	—		Connector 54928-0610 (Molex or an equivalent product)
Servo motor power supply connectors (for CNP2)	③2	Motor power supply connector set (amplifier side) for MR-E-10A/AG to 100A/AG-KH003 (press bonding type)	MR-ECNP2-A (Unit: 20 pcs/box)	—		Connector 51240-0300 (Molex or an equivalent product) Terminal 56125-0128 (Molex or an equivalent product)
	③3	Motor power supply connector (amplifier side) for MR-E-10A/AG to 100A/AG-KH003 (insertion type)	MR-ECNP2-B (Unit: 20 pcs/box)	—		Connector 54927-0310 (Molex or an equivalent product)
	③4	Motor power supply connector set (amplifier side) for MR-E-200A/AG-KH003 (press bonding type)	MR-ECNP2-A1 (Unit: 20 pcs/box)	—		Connector 54241-0300 (Molex or an equivalent product) Terminal 56125-0128 (Molex or an equivalent product)
	③5	Motor power supply connector (amplifier side) for MR-E-200A/AG-KH003 (insertion type)	MR-ECNP2-B1 (Unit: 20 pcs/box)	—		Connector 54928-0310 (Molex or an equivalent product)


Ordering Information for Customers

To order the following products, contact the relevant manufacturers directly.



When manufacturing a cable with the following connectors, refer to the relevant manufacturers' instruction manuals for wiring and assembling procedures.

● Encoder connectors

For HF-KN series


Servo motor	Model	Feature	Description	Applicable cable example
HF-KN series	1674320-1	IP65 (Note 1)	 Manufacturer: TE connectivity Ltd.	Wire size: 0.14mm ² (AWG26) to 0.3mm ² (AWG22) Completed cable outer diameter: $\phi 7.1 \pm 0.3$ mm Crimping tools: 1596970-1 (for ground clip) and 1596847-1 (for receptacle contact) are required. Wire example: Fluoric resin wire (Vinyl jacket cable ETFE SVP 70/0.08 (AWG#22)-3P-KB-16824 BANDO DENSEN Co., LTD. or an equivalent product)

For HF-SN series



Servo motor	Connector			Contact	Feature	Description	Applicable cable example	
	Type	Plug (Note 2)	Socket contact				Wire size	Completed cable outer diameter
HF-SN series	Straight	CM10-SP10S-M(D6)	CM10-#22SC(C1)(D8)-100	Press bonding type	IP67 (Note 1)	<Straight type>  Manufacturer: DDK Ltd.	0.3mm ² (AWG22) to 0.5mm ² (AWG20) Crimping tool (357J-50446T) is required.	$\phi 6.0$ mm to $\phi 9.0$ mm
			CM10-#22SC(C2)(D8)-100				0.08mm ² (AWG28) to 0.25mm ² (AWG23) Crimping tool (357J-50447T) is required.	
			CM10-#22SC(S1)(D8)-100	Solder type			0.5mm ² (AWG20) or smaller	
	Angled	CM10-AP10S-M(D6)	CM10-#22SC(C1)(D8)-100	Press bonding type	IP67 (Note 1)	<Angled type>  Manufacturer: DDK Ltd.	0.3mm ² (AWG22) to 0.5mm ² (AWG20) Crimping tool (357J-50446T) is required.	
			CM10-#22SC(C2)(D8)-100				0.08mm ² (AWG28) to 0.25mm ² (AWG23) Crimping tool (357J-50447T) is required.	
			CM10-#22SC(S1)(D8)-100	Solder type			0.5mm ² (AWG20) or smaller	

● Servo motor power supply connectors

For HF-KN series

Servo motor	Model	Feature	Description	Applicable cable example
HF-KN series	JN4FT04SJ1-R (plug) ST-TMH-S-C1B-100-(A534G) (socket contact)	IP65 (Note 1)	 Manufacturer: Japan Aviation Electronics Industry, Ltd.	Wire size: 0.75mm ² (AWG19) Completed cable outer diameter: $\phi 6.2 \pm 0.3$ mm Crimping tool: CT160-3-TMH5B (for contact) is required. Wire example: Fluoric resin wire (Vinyl jacket cable RMFES-A (CL3X) AWG19 4 cores DYDEN CORPORATION or an equivalent product)

For HF-SN series

Servo motor	Plug (with backshell)		Cable clamp	Feature	Description	Applicable cable example	
	Type	Model	Model			Wire size	Completed cable outer diameter
HF-SN52J, 102J, 152J	Straight	CE05-6A18-10SD-D-BSS	CE3057-10A-2-D	IP67 (Note 1) EN standards	<Straight type> 	2mm ² (AWG14) to 3.5mm ² (AWG12)	φ8.5mm to φ11mm
			CE3057-10A-1-D				φ10.5mm to φ14.1mm
	Angled	CE05-8A18-10SD-D-BAS	CE3057-10A-2-D	General environment (Note 3)	Manufacturer: DDK Ltd.		φ8.5mm to φ11mm
			CE3057-10A-1-D				φ10.5mm to φ14.1mm
	Angled	D/MS3108B18-10S	D/MS3057-10A		φ14.3mm or smaller (Inner diameter of bushing)		
HF-SN202J	Straight	CE05-6A22-22SD-D-BSS	CE3057-12A-2-D	IP67 (Note 1) EN standards	<Angled type> 	2mm ² (AWG14) to 8mm ² (AWG8)	φ9.5mm to φ13mm
			CE3057-12A-1-D				φ12.5mm to φ16mm
	Angled	CE05-8A22-22SD-D-BAS	CE3057-12A-2-D	General environment (Note 3)	Manufacturer: DDK Ltd.		φ9.5mm to φ13mm
			CE3057-12A-1-D				φ12.5mm to φ16mm
	Angled	D/MS3108B22-22S	D/MS3057-12A		φ15.9mm or smaller (Inner diameter of bushing)		

Notes: 1. The IP rating indicated is for the connector's protection against ingress of dust and water when coupled to a servo amplifier/servo motor. If the IP rating of the servo amplifier/servo motor differs from that of these connectors, overall IP rating depends on the lowest of all.


2. Select from below if there is a potential risk that a high vibration may be applied to connectors.

CM10-SP10S-VP-M (straight type) or CM10-AP10S-VP-M (angled type)



3. Not compliant with EN standards.

● Servo motor brake connectors

For HF-KN series

Servo motor	Model	Feature	Description	Applicable cable example
HF-KN series	JN4FT02SJ1-R (plug) ST-TMH-S-C1B-100-(A534G) (socket contact)	IP65 (Note 1)	 Manufacturer: Japan Aviation Electronics Industry, Ltd.	Wire size: 0.5mm ² (AWG20) Completed cable outer diameter: $\phi 4.5 \pm 0.3$ mm Crimping tool: CT160-3-TMH5B (for contact) is required. Wire example: Fluoric resin wire (Vinyl jacket cable RMFES-A (CL3X) AWG20 2 cores DYDEN CORPORATION or an equivalent product)

For HF-SN series

Servo motor	Connector			Contact	Feature	Description	Applicable cable example		
	Type	Plug (Note 2)	Socket contact				Wire size	Completed cable outer diameter	
HF-SN series	Straight	CM10-SP2S-S(D6)	CM10-#22SC(S2)(D8)-100	Solder type	IP67 (Note 1)	 Manufacturer: DDK Ltd.	1.25mm ² (AWG16) or smaller	φ4.0mm to φ6.0mm	
		CM10-SP2S-M(D6)						φ6.0mm to φ9.0mm	
		CM10-SP2S-L(D6)						φ9.0mm to φ11.6mm	
		CM10-SP2S-S(D6)	CM10-#22SC(C3)(D8)-100	Press bonding type				0.5mm ² (AWG20) to 1.25mm ² (AWG16) Crimping tool (357J-50448T) is required.	φ4.0mm to φ6.0mm
		CM10-SP2S-M(D6)							φ6.0mm to φ9.0mm
		CM10-SP2S-L(D6)							φ9.0mm to φ11.6mm
	Angled	CM10-AP2S-S(D6)	CM10-#22SC(S2)(D8)-100	Solder type	IP67 (Note 1)	 Manufacturer: DDK Ltd.	1.25mm ² (AWG16) or smaller		φ4.0mm to φ6.0mm
		CM10-AP2S-M(D6)							φ6.0mm to φ9.0mm
		CM10-AP2S-L(D6)							φ9.0mm to φ11.6mm
		CM10-AP2S-S(D6)	CM10-#22SC(C3)(D8)-100	Press bonding type				0.5mm ² (AWG20) to 1.25mm ² (AWG16) Crimping tool (357J-50448T) is required.	φ4.0mm to φ6.0mm
		CM10-AP2S-M(D6)							φ6.0mm to φ9.0mm
		CM10-AP2S-L(D6)							φ9.0mm to φ11.6mm

Notes: 1. The IP rating indicated is for the connector's protection against ingress of dust and water when coupled to a servo amplifier/servo motor. If the IP rating of the servo amplifier/servo motor differs from that of these connectors, overall IP rating depends on the lowest of all.

2. Select from below if there is a potential risk that a high vibration may be applied to connectors.
CM10-SP2S-VP-S/M/L (straight type) or CM10-AP2S-VP-S/M/L (angled type)

Peripheral Equipment

● Power factor improvement reactor (FR-HAL)

This reactor enables users to boost the servo amplifier's power factor and reduce its power supply capacity.

Model	Applicable servo amplifier	
	3-phase power supply	1-phase power supply
FR-HAL-0.4K	MR-E-10A/AG-KH003, MR-E-20A/AG-KH003	—
FR-HAL-0.75K	MR-E-40A/AG-KH003	MR-E-10A/AG-KH003, MR-E-20A/AG-KH003
FR-HAL-1.5K	MR-E-70A/AG-KH003	MR-E-40A/AG-KH003
FR-HAL-2.2K	MR-E-100A/AG-KH003	MR-E-70A/AG-KH003
FR-HAL-3.7K	MR-E-200A/AG-KH003	—

External dimensions

(Unit: mm)

Connections

Terminal arrangement
R S T X Y Z

4-d mounting hole (Note 1)

D or shorter

H

W1

W

D2

D1

d

MCCB MC FR-HAL

Power supply 3-phase 200 to 230VAC

X Y Z

L1 L2 L3

(Note 1) MCCB MC FR-HAL

Power supply 1-phase 230VAC

X Y

L1 L2

Notes: 1. When using a power supply, 1-phase 230VAC, connect the power supply to L1 and L2 terminals. Do not connect anything to L3. The 1-phase 230VAC is available only for the MR-E-70A/AG-KH003 or smaller servo amplifier.

Model	W	W1	H	D	D1	D2	d	Mass kg (lb)
FR-HAL-0.4K	104	84	99	72	51	40	M5	0.6 (1.4)
FR-HAL-0.75K	104	84	99	74	56	44	M5	0.8 (1.8)
FR-HAL-1.5K	104	84	99	77	61	50	M5	1.1 (2.5)
FR-HAL-2.2K	115	40	115	77	71	57	M6	1.5 (3.3)
FR-HAL-3.7K	115	40	115	83	81	67	M6	2.2 (4.9)

Notes: 1. Use this mounting hole for grounding.

Peripheral Equipment

● EMC filter

The following filters are recommended as a filter compliant with the EMC directive for the servo amplifier's power supply.

Model	Applicable servo amplifier	Fig.
SF1252	MR-E-10A/AG-KH003 to MR-E-100A/AG-KH003	A
SF1253	MR-E-200A/AG-KH003	B

External dimensions

(Unit: mm)

Connections

● SF1252

Model	Mass kg (lb)
SF1252	0.75 (1.7)

Notes: 1. When using a power supply, 1-phase 230VAC, connect the power supply to the L1 and L2 terminals. Do not connect anything to L3. The 1-phase 230VAC is available only for the MR-E-70A/AG-KH003 or smaller servo amplifier.
2. Connect when the power supply has an earth connection.

● SF1253

Model	Mass kg (lb)
SF1253	1.37 (3.0)

● Electrical wires, molded case circuit breakers and magnetic contactors

The following are examples of wire sizes when 600V grade heat-resistant polyvinyl chloride insulated wires (IV wires) with a length of 30m are used.

Servo amplifier	Molded case circuit breaker	Magnetic contactor (Note 2)	Electrical wire size (mm ²)			
			L1, L2, L3, ⊕	U, V, W, ⊕	P, C, D	B1, B2
MR-E-10A/AG-KH003	30A frame 5A	S-N10	2 (AWG14)	1.25 (AWG16) (Note 3)	2 (AWG14)	1.25 (AWG16) (Note 4)
MR-E-20A/AG-KH003	30A frame 5A					
MR-E-40A/AG-KH003	30A frame 10A					
MR-E-70A/AG-KH003	30A frame 15A					
MR-E-100A/AG-KH003	30A frame 15A					
MR-E-200A/AG-KH003	30A frame 20A	S-N18	2.5 (AWG14) (Note 1)	2.5 (AWG14) (Note 1)		

Notes: 1. When using AWG14 at an ambient temperature of 40°C (104°F) or higher, use heat-resistant PVC (rated 105°C [221°F] or higher). Refer to the specifications in this catalog for the permissible ambient temperature of the servo amplifier and the servo motor.

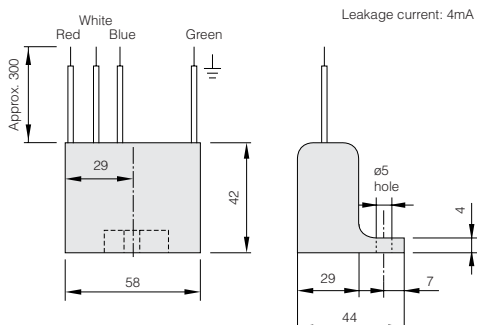
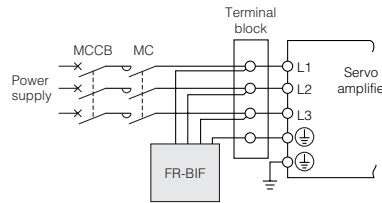
2. Be sure to use a magnetic contactor (MC) with an operation delay time of 80ms or less. The operation delay time is the time interval between current being applied to the coil until closure of contacts.

3. Use a fluoroc resin wire (0.75mm² (AWG19)) when connecting to servo motor power supply connector.

4. Use a fluoroc resin wire (0.5mm² (AWG20)) when connecting to servo motor electromagnetic brake connector.

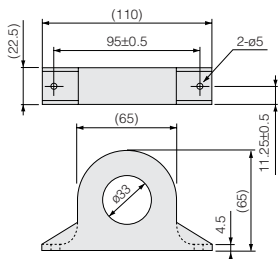
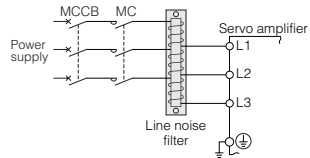
● Radio noise filter (FR-BIF)

This filter effectively controls noise emitted from the power supply side of the servo amplifier and is especially effective for radio frequency bands 10MHz or lower. The FR-BIF is designed for the input only.

External dimensions (Unit: mm)	Connections
 <p>Leakage current: 4mA</p>	<p>This filter is not connectable to output side of the servo amplifier. Wiring should be as short as possible. Grounding is always required. Be sure to insulate the unused wire when using FR-BIF with 1-phase power supply.</p> 

● Line noise filter (FR-BSF01)

This filter is effective in suppressing radio noise emitted from the power supply side or output side of the servo amplifier, and also in suppressing high-frequency leakage current (zero-phase current), especially within 0.5MHz to 5MHz band.

External dimensions (Unit: mm)	Connections
<p>FR-BSF01</p> 	<p>Use the line noise filter for wires of the main circuit power supply (L1, L2, L3) of the servo amplifier, and of the servo motor power supply (U, V, W). Pass each of the wires through the line noise filter equal times in a same direction. For the main circuit power supply, the effect of the filter rises as the number of passes increases, but generally four passes would be appropriate. For the servo motor power supply, passes must be four times or less. Do not pass the grounding (earth) wire through the filter, or the effect of the filter will drop. Wind the wires to pass through the filter as the required number of passes as shown in the diagram below. If the wires are too thick to wind, use two or more filters to have the required number of passes. Place the line noise filters as close to the servo amplifier as possible for their best performance.</p> 

● Data line filter

Noise can be prevented by attaching a data line filter to the pulse output cable of the pulse train output controller or to the servo motor encoder cable.

Example

Data line filter: ESD-SR-250 (manufactured by NEC TOKIN Corporation) or ZCAT3035-1330 (manufactured by TDK Corporation)

● Surge killer

Attach surge killers to AC relays and AC valves around the servo amplifier. Attach diodes to DC relays and DC valves.

Example

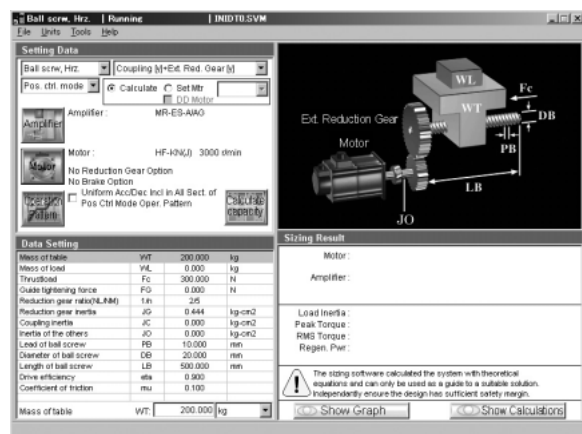
Surge killer : CR-50500 (manufactured by Okaya Electric Industries Co., Ltd.)

Diode : A diode with breakdown voltage four or more times greater than the relay's drive voltage, and with current capacity two or more times greater than the relay's drive current.

Servo Support Software

Capacity selection software

●MRZJW3-MOTSZ111E



A user-friendly design facilitates selecting the optimum servo amplifier, servo motor (including the servo motor with an electromagnetic brake) and optional regeneration unit just by entering constants and an operation pattern into machine-specific windows.

Features

- (1) User-defined operation patterns can be set. The operation pattern can be selected from the position control mode operation or speed control mode operation. The selected operation pattern can be also displayed in the graph.
- (2) The feedrate (or servo motor speed) and torque can be displayed in the graph during the selection process.

*The screen is for reference and may differ from the actual screen.

● Specifications

Item		Description
Types of machine component		Horizontal ball screws, vertical ball screws, rack and pinions, roll feeds, rotating tables, carts, elevators, conveyors and other (direct inertia input) devices
Output of results	Items	Selected servo amplifier, selected servo motor, selected optional regeneration unit, load inertia moment, load to motor inertia ratio, peak torque, peak torque ratio, effective torque, effective torque ratio, regenerative power, regenerative power ratio
	Printing	Prints entered specifications, operation pattern, calculation process, graph of selection process feedrate (or motor speed) and torque, and sizing results.
	Data saving	Entered specifications, operation patterns and selection results are saved with a file name.
Inertia moment calculation function		Cylinder, core alignment column, variable speed, linear movement, suspension, conical, truncated cone



● Operating conditions of personal computer

IBM PC/AT compatible model running with the following operation conditions.

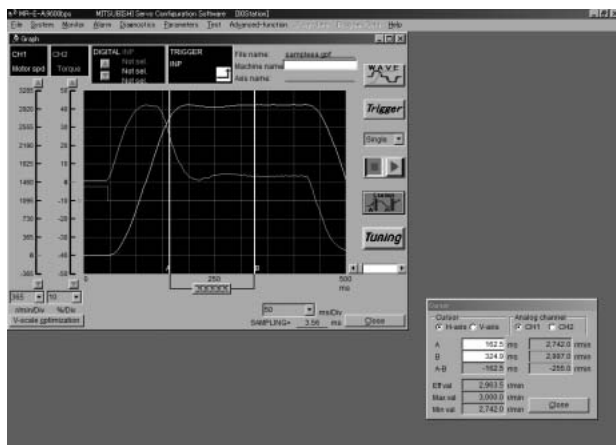
Components		MRZJW3-MOTSZ111E (Note 5)	
Personal computer (Note 1, 2)	OS (Note 3, 4)	Windows® 98, Windows® Me, Windows® 2000 Professional, Windows® XP Home Edition/Professional, Windows Vista® Home Basic/Home Premium/Business/Ultimate/Enterprise Windows® 7 Starter/Home Premium/Professional/Ultimate/Enterprise	
	Processor	Pentium® 133MHz or more Pentium® 150MHz or more Pentium® 300MHz or more 32-bit (x86) processor of 1GHz or more	(Windows® 98, Windows® 2000 Professional) (Windows® Me) (Windows® XP Home Edition/Professional) (Windows Vista® Home Basic/Home Premium/Business/Ultimate/Enterprise, Windows® 7 Starter/Home Premium/Professional/Ultimate/Enterprise)
	Memory	24MB or more 32MB or more 128MB or more 512MB or more 1GB or more	(Windows® 98) (Windows® Me, Windows® 2000 Professional) (Windows® XP Home Edition/Professional) (Windows Vista® Home Basic) (Windows Vista® Home Premium/Business/Ultimate/Enterprise, Windows® 7 Starter/Home Premium/Professional/Ultimate/Enterprise)
	Free hard disk space	40MB or more	
	Communication interface	—	
Browser		Internet Explorer4.0 or above	
Monitor		Resolution 800 x 600 or more, 16-bit high color	
Keyboard		Compatible with above personal computers.	
Mouse		Compatible with above personal computers.	
Printer		Compatible with above personal computers.	
Communication cable		Not required	

Notes: 1. Pentium is registered trademark of Intel Corporation. Windows and Windows Vista are registered trademarks of Microsoft Corporation in the United States and other countries.
2. This software may not run correctly, depending on a personal computer being used.
3. Software version C0 or above is compatible with Windows Vista® and C4 or above with Windows® 7.
4. This software is not compatible with 64-bit operating system.
5. Software version C4 or above is compatible with HF-KN(J) and HF-SN(J) servo motor series.

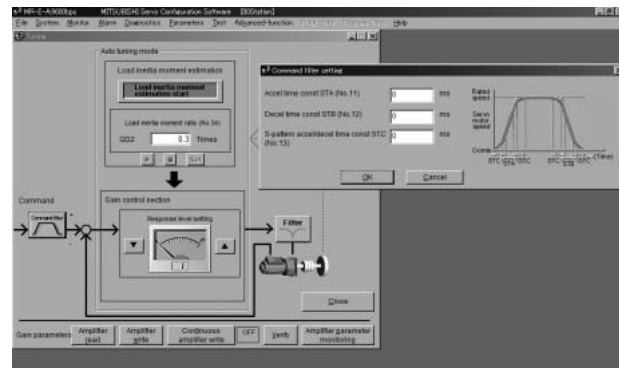
MR Configurator (Setup software)

● MRZJW3-SETUP154E (E:English)

This software makes it easy to perform monitor display, diagnostic, reading and writing of parameters, and test operations from the setup with a personal computer.



★The screens are for reference and may differ from the actual screens.



Features

- (1) This software allows easy set up and tuning your servo system with a personal computer.
- (2) Multiple monitor functions
Graphic display functions are provided to display the servo motor status with the input signal triggers, such as the command pulse, droop pulse and speed.
- (3) Test operations with a personal computer
Test operation of the servo motors can be performed with a personal computer.

● Specifications

Main menu	Functions
Monitors	Batch display, high speed monitor, trend graph
Alarms	Alarm display, alarm history, display of data that generated alarm
Diagnostics	Digital I/O display, reason for rotation failure display, power ON count display, amplifier version info display, motor information display, tuning data display, automatic voltage control offset display (Note 3), axis name setting
Parameters	Parameter setting, display of change list, tuning, display of detailed information
Test operations	JOG operation, positioning operation (Note 4), motor-less operation, forced digital output, program operation using simple language (Note 4)
Advanced function	Machine analyzer, gain search (Note 4), machine simulation
File	Data reading, saving and printing
Others	Automatic operation, help display (Note 6)

● Operating conditions

Components		MRZJW3-SETUP154E (Note 1)	
Personal computer (Note 2)	OS (Note 5)	Windows® 95, Windows® 98, Windows® Me, Windows NT® Workstation 4.0, Windows® 2000 Professional, Windows® XP Home Edition/Professional, Windows Vista® Home Basic/Home Premium/Ultimate/Enterprise, Windows® 7 Starter/Home Premium/Professional/Ultimate/Enterprise	
	Processor	Pentium® 133MHz or more Pentium® 150MHz or more Pentium® 300MHz or more 32-bit (x86) processor of 1GHz or more	(Windows® 95, Windows® 98, Windows NT® Workstation 4.0, Windows® 2000 Professional) (Windows® Me) (Windows® Home Edition/Professional) (Windows Vista® Home Basic/Home Premium/Business/Ultimate/Enterprise, Windows® 7 Starter/Home Premium/Professional/Ultimate/Enterprise)
	Memory	16MB or more (Windows® 95) 24MB or more (Windows® 98) 32MB or more (Windows® Me, Windows NT® Workstation 4.0, Windows® 2000 Professional) 128MB or more (Windows® XP Home Edition/Professional) 512MB or more (Windows Vista® Home Basic) 1GB or more (Windows Vista® Home Premium/Business/Ultimate/Enterprise, Windows® 7 Starter/Home Premium/Professional/Ultimate/Enterprise)	
	Free hard disk space	60MB or more	
	Communication interface	Serial port	
Monitor		Resolution 800X600 or more, 16-bit high color	
Keyboard		Compatible with above personal computers.	
Mouse		Compatible with above personal computers. Note that serial mice are incompatible.	
Printer		Compatible with above personal computers.	
Communication cable		QC30R2	

Notes: 1. Pentium is registered trademark of Intel Corporation. Windows and Windows NT are registered trademarks of Microsoft Corporation in the United States and other countries.

2. This software may not run correctly, depending on the personal computer being used.

3. The automatic voltage control offset display is available only with the MR-E-AG type.

4. Positioning operation, program operation using simple language and gain search are available only with the MR-E-A type.

5. Software version E2 or above is compatible with Windows Vista® and Windows® 7.

6. Windows Help (WinHlp32.exe) program is not included in Windows Vista® or above by default. Download and install WinHlp32.exe from the Microsoft Download Center to view Windows Help.

Cautions Concerning Use

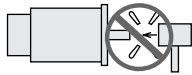
To ensure safe use

- To use the products given in this catalog properly, always read the "Installation Guide" before starting to use them.

Cautions concerning use

Transportation and installation of servo motor

- Protect the servo motor and the encoder from impact during handling. When installing a pulley or a coupling to the shaft, do not hammer on the shaft. Impact may damage the encoder. When installing the pulley or the coupling to the servo motor which has a key shaft, use the screw hole on the shaft-end. Use a pulley extractor when removing the pulley.



- Do not apply a load exceeding the tolerable load onto the servo motor shaft. The shaft may break.

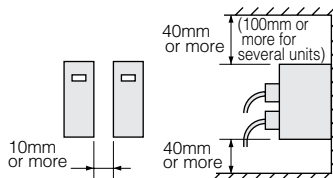
Installation

- Avoid installation in an environment in which oil mist, dust, etc. are in the air. When using in such an environment, enclose the servo amplifier in a sealed cabinet. Protect the servo motor by furnishing a cover for it or by taking similar measures.
- Mount the servo amplifier vertically on a wall.
- Do not block intake and exhaust areas of the servo amplifier. Doing so may cause the servo amplifier to malfunction.
- When installing several servo amplifiers in a row in a sealed cabinet, leave 10mm or more open between each servo amplifier.

When using one servo amplifier, always leave 40mm or more open in the upward and downward directions.

To ensure the life and reliability, keep space as open as possible toward the top plate so that heat does not build up.

Take special care, especially when installing several servo amplifiers in a row.



- Be sure to use the servo motor within the specified ambient temperature. Torque may drop due to temperature increase of the servo motor.
- The servo motor can be mounted in any direction. When mounting vertically (shaft-up), take measures on the machine-side to ensure that oil from the gear box does not get into the servo motor.

- Do not touch the servo motor during or after operation until it has had sufficient time to cool. The servo motor can be very hot, and severe burns may result from touching the servo motor.
- The optional regeneration unit becomes hot (the temperature rise of 100°C or higher) with frequent use. Do not install within flammable objects or objects subject to thermal deformation. Take care to ensure that electrical wires do not come into contact with the unit.
- Carefully consider the cable clamping method, and make sure that bending stress and stress of the cable's own weight are not applied on the cable connection section.
- If using in an application where the servo motor moves, select the cable bending radius according to the required bending life and wire type.
- Fix the power supply and encoder cables led out from the servo motor onto the servo motor so that they do not move. Failure to do so may result in disconnections. Do not modify the connector or terminals, etc., on the end of the cable.

Grounding

- Securely ground to prevent electric shocks and to stabilize the potential in the control circuit.
- To ground the servo motor and the servo amplifier at one point, connect the grounding terminals of each unit, and ground from the servo amplifier side.
- Faults such as position mismatch may occur if the grounding is insufficient.

Wiring

- When a commercial power supply is applied to the servo amplifier's output terminals (U, V, W), the servo amplifier will be damaged. Before switching the power on, perform thorough wiring and sequence checks to ensure that there are no wiring errors, etc.
- When a commercial power supply is applied to the servo motor's input terminals (U, V, W), the servo motor will be damaged. Connect the servo motor to the servo amplifier's output terminals (U, V, W).
- Match the phase of the servo motor's input terminals (U, V, W) to the servo amplifier's output terminals (U, V, W) when connecting. If they do not match, the servo motor cannot be controlled.
- For position or speed control mode, connect the stroke end signals (LSP, LSN) to the common terminal (SG). The servo motor will not start if the signals are invalid.
- Do not use the 24VDC interface power supply for the electromagnetic brake. Provide a power supply designed exclusively for the electromagnetic brake.
- Connect P and D on the power supply connector (CNP1) when using the built-in regenerative resistor.

Factory settings

- All available combinations of the servo motor and the servo amplifier are predetermined. Confirm the models of the servo motor and the servo amplifier to be used before installation.
- Select the control mode, the servo motor series and capacity by parameter No. 0.
- For MR-E-□A-KH003, position control mode is selected as default. Change the parameter setting when using speed control mode.
- For MR-E-□AG-KH003, speed control mode is set as default. Change the setting value when using torque control mode.
- When using the optional regeneration unit, change parameter No.0. The optional regeneration unit is disabled as default, so the parameter must be changed to increase the regeneration performance.

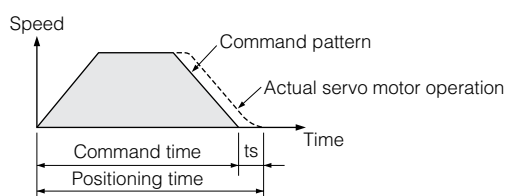
Operation

- When a magnetic contactor (MC) is installed on the servo amplifier's primary side, do not perform frequent starts and stops with the MC. Doing so may cause the servo amplifier to malfunction.
- Turn the MC off if an alarm occurs.
- When an error occurs, the servo amplifier's safety features activates, halting output, and the dynamic brake instantly stops the servo motor.
- The dynamic brake is a function for emergency stop. Do not use it for stopping the servo motor in normal operations.
- As a rough guide, the dynamic brake can be used approximately 1000 times when a machine that has load to motor inertia ratio equals to or lower than the recommended ratio stops from the rated speed every 10 minutes.
- When using the servo motor with an electromagnetic brake, do not apply the electromagnetic brake when the servo is on. Doing so may cause the servo amplifier overload or shorten the brake life. Apply the electromagnetic brake when the servo is off.

- Moment of inertia of the load should be below the recommended load to motor inertia ratio of the servo motor being used. If it is too large, desired performance may not be attainable.

Cautions concerning model selection

- Select the servo motor with a rated torque above the continuous effective load torque.
- When unbalanced torque is generated, such as in a vertical lift machine, it is recommended that the unbalanced torque of the machine be kept under 70% of the motor's rated torque.
- Design the operation pattern in the command section so that positioning can be completed, taking the stop setting time (t_s) into account.



Warranty

1. Warranty period and coverage

We will repair any failure or defect hereinafter referred to as “failure” in our FA equipment hereinafter referred to as the “Product” arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit is repaired or replaced.

[Term]

The term of warranty for Product is twelve (12) months after your purchase or delivery of the Product to a place designated by you or eighteen (18) months from the date of manufacture whichever comes first (“Warranty Period”). Warranty period for repaired Product cannot exceed beyond the original warranty period before any repair work.

[Limitations]

- (1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule. It can also be carried out by us or our service company upon your request and the actual cost will be charged. However, it will not be charged if we are responsible for the cause of the failure.
- (2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.
- (3) Even during the term of warranty, the repair cost will be charged on you in the following cases;
 - (i) a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
 - (ii) a failure caused by any alteration, etc. to the Product made on your side without our approval
 - (iii) a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
 - (iv) a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
 - (v) any replacement of consumable parts (battery, fan, smoothing capacitor, etc.)
 - (vi) a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
 - (vii) a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
 - (viii) any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop of production

- (1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued. The announcement of the stop of production for each model can be seen in our Sales and Service, etc.
- (2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries

Our regional FA Center in overseas countries will accept the repair work of the Product. However, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA Center for details.

4. Exclusion of responsibility for compensation against loss of opportunity, secondary loss, etc.

Whether under or after the term of warranty, we assume no responsibility for any damages arisen from causes for which we are not responsible, any losses of opportunity and/or profit incurred by you due to a failure of the Product, any damages, secondary damages or compensation for accidents arisen under a specific circumstance that are foreseen or unforeseen by our company, any damages to products other than the Product, and also compensation for any replacement work, readjustment, start-up test run of local machines and the Product and any other operations conducted by you.

5. Change of Product specifications

Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Application and use of the Product

- (1) For the use of our General-Purpose AC Servo, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in General-Purpose AC Servo, and a backup or fail-safe function should operate on an external system to General-Purpose AC Servo when any failure or malfunction occurs.
- (2) Our General-Purpose AC Servo is designed and manufactured as a general purpose product for use at general industries. Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used.
In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.
We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

MEMO

This image shows a full page of a worksheet designed for handwriting practice. It features 20 evenly spaced, horizontal dashed lines across the entire width of the page. The background is plain white, and there are no margins, text, or other markings present.

[illegible]

Global FA Centers



Shanghai FA Center	Mitsubishi Electric Automation (CHINA) Ltd. 4/F., Zhi Fu Plaza No.80 Xin Chang Road, Shanghai, 200003, China Tel: 86-21-2322-3030 Fax: 86-21-2322-3000	India FA Center	Mitsubishi Electric India Pvt. Ltd. India Factory Automation Centre 2nd Floor, DLF Building No.9B, DLF Cyber City Phase III, Gurgaon 122002, Haryana, India Tel: 91-124-4630300 Fax: 91-124-4630399
Beijing FA Center	Mitsubishi Electric Automation (CHINA) Ltd. Beijing Office Unit904-905, 9F, Office Tower, Henderson Centre, 18 Jianguomennei Avenue, Dongcheng District, Beijing, China Tel: 86-10-6518-8830 Fax: 86-10-6518-3907	North American FA Center	Mitsubishi Electric Automation, Inc. 500 Corporate Woods Parkway, Vernon Hills, IL 60061, U.S.A Tel: 1-847-478-2100 Fax: 1-847-478-2253
Tianjin FA Center	Mitsubishi Electric Automation (CHINA) Ltd. Tianjin Office B-2-801-802, Youyi Building, 50 Youyi Road, Hexi District, Tianjin, China Tel: 86-22-2813-1015 Fax: 86-22-2813-1017	Brazil FA Center	MELCO-TEC Representacao Comercial e Assessoria Tecnica Ltda. Av. Paulista, 1439, Cerqueira Cesar - Sao Paulo Brazil - CEP 01311-200 Tel: 55-11-3146-2200 Fax: 55-11-3146-2217
Guangzhou FA Center	Mitsubishi Electric Automation (CHINA) Ltd. Guangzhou Office Rm.1609, North Tower, The Hub Center, No.1068, Xin Gang East Road, Haizhu District, Guangzhou, China Tel: 86-20-8923-6730 Fax: 86-20-8923-6715	European FA Center	Mitsubishi Electric Europe B.V. Polish Branch ul. Krakowska 50, 32-083 Balice, Poland Tel: 48-12-630-4700 Fax: 48-12-630-4701
Taiwan FA Center	Setsuyo Enterprise Co., Ltd. 6F No.105 Wu kung 3rd RD, Wu-Ku Hsiang, Taipei Hsien, 248, Taiwan, R.O.C. Tel: 886-2-2299-2499 Fax: 886-2-2299-2509	German FA Center	Mitsubishi Electric Europe B.V. - German Branch Gothaer Strasse 8, D-40880 Ratingen, Germany Tel: 49-2102-486-0 Fax: 49-2102-486-1120
Korean FA Center	Mitsubishi Electric Automation Korea Co., Ltd. (Service) B1F, 2F, 1480-6, Gayang-Dong, Gangseo-Gu, Seoul, 157-200, Korea Tel: 82-2-3660-9630 Fax: 82-2-3663-0475	Czech Republic FA Center	Mitsubishi Electric Europe B.V. -o.s. Czech office Avenir Business Park, Radicka 714/113a, 158 00 Praha5, Czech Republic Tel: 420-251-551-470 Fax: 420-251-551-471
Thailand FA Center	Mitsubishi Electric Automation (Thailand) Co., Ltd. Bang-Chan Industrial Estate No.111, Soi Serithai 54, T.Kannayao, A.Kannayao, Bangkok 10230, Thailand Tel: 66-2906-3238 Fax: 66-2906-3239	UK FA Center	Mitsubishi Electric Europe B.V. UK Branch Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, UK. Tel: 44-1707-27-6100 Fax: 44-1707-27-8695
ASEAN FA Center	Mitsubishi Electric Asia Pte. Ltd. ASEAN Factory Automation Centre 307 Alexandra Road #05-01/02, Mitsubishi Electric Building, Singapore Tel: 65-6470-2460 Fax: 65-6476-7439	Russian FA Center	Mitsubishi Electric Europe B.V. Russian Branch St.Petersburg office Sverdlovskaya emb., bld "Sch", BC "Benuea", office 720; 195027, St.Petersburg, Russia Tel: 7-812-633-3497 Fax: 7-812-633-3499

Mitsubishi Electric Corporation Nagoya Works is a factory certified for ISO14001 (standards for environmental management systems) and ISO9001 (standards for quality assurance management systems)



Safety Warning

To ensure proper use of the products listed in this catalog,
please be sure to read the instruction manual prior to use.

mitsubishi **ELECTRIC CORPORATION**

HEAD OFFICE: TOKYO BLDG., 2-7-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN